American Machinist

January 13, 1937

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YOUR NEXT ISSUE

. . . the most complete listing and description of modern shop equipment, accessories, tools, materials, and supplies that you can get . . . an invaluable guide for your buying . . . study it, and keep it where you can refer to it easily, all through 1937.

24th ANNUAL REVIEW AND CATALOG NUMBER of AMERICAN MACHINIST

January 27

Talking Shop

Talking Shop

Readers of *American Machinist* are interested first of all in their daily job of working metals while they are reading the paper. For that reason *American Machinist* has been for sixty years essentially a technical magazine. Its editors are interested in political and economic questions as they affect the industry and the men in it—and in no other way so long as they are editing the paper. Off the job they are just as much concerned with such matters as the readers are, when they are off their jobs.

Some months ago this department was started to give the editors a chance to talk less formally about shop matters than seemed desirable in an editorial. The experiment has been received favorably. Now it seems wise to open the editorial section of the magazine with a page where nothing but shop talk will appear. "Talking Shop" therefore moves up.

The questions discussed on this page are ones that come up as the editors visit with shop men in their

plants and offices, and at engineering and trade gatherings. They are questions that are alive right now, for some readers at least. And they are more than likely to be live topics for other readers sooner or later.

While the editors will probably have to do most of the talking on this page they will welcome shop talk from readers and will use it where it fits. And they will be grateful for comments and criticisms, bouquets or dead cats.

National and international questions will be treated elsewhere in the magazine whenever it is evident that they have a bearing on the affairs of readers of *American Machinist*. This page will be reserved for shop talk, and for shop talk only.

Large Sheets or Welds?

Butt welding of sheets, such as are used in automobile bodies, is now being done with an accuracy that was impossible a few years ago. In fact this advance may have an effect on the rolling of the steel sheets themselves. New body designs call for large sheets for roofs and back panels. When made in one piece this construction takes very large sheets, and dies and presses must be both large and expensive. Further, the

loss due to spoilage runs up to 25 per cent or more.

Some engineers are asking if it is not cheaper to use smaller pieces and weld them together. They feel that the lower cost of sheets, of dies and presses, not to mention spoilage, will more than pay for the welding, plus the cost of trimming the flash.

A Surprise Bonus

We know a time study man who worked faithfully for a manufacturer of small metal products for a matter of a year or two, and then left about the middle of last year to accept a better job. When the end of the year came along he received a check for more than $200 with a letter to the effect that he had earned that much bonus during the portion of the year he had been with the company.

Somebody in that company understands industrial relations, and public relations as well. The man who got the bonus had not the slightest expectation of getting it because he had left the company months before and because he was on a straight salary basis. But he has already told his old friends in the company of the generous treatment accorded him, and he is telling other people about it. Obviously, such an act will do this company a lot of good with such of its customers and suppliers as learn of it. We'll be glad to tell you who it is, if you are curious.

Caskets and Cartridges

Something over 20 years ago we were invited to visit the Ferracute Machine Company to see a large press on an unusually large drawing operation. The press was built to make caskets out of one piece of steel, a deep draw for those days, before the bath tub type of automobile fender became an everyday product. A recent visit to this plant revealed an aftermath that was a bit gruesome.

The casket company failed and the press, with a large supply of caskets, was taken over by a concern which later used it in making shells for the Allied armies in France. The caskets were then used for packing cases to

carry the shells to the loading plants. Could anything be more appropriate? Carrying cartridge shells to make occupants for the caskets themselves! —*The Editors.*

Machinery Markets in 1937

Momentum acquired during 1936 promises to carry us on through 1937 and to raise business index curves to higher levels

K. H. CONDIT
Editor

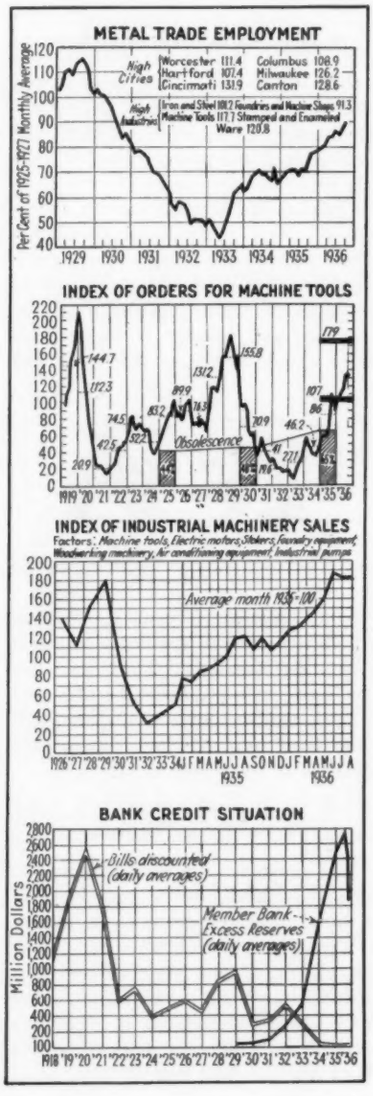
WHATEVER one's connection with the metal-working and machinery industry may be his future is securely tied up with the markets for the products of the industry. To some good markets mean profits, to others a steady job. What are the prospects in the year that has just begun?

As we examine the facts before us now we find that the shortage of skilled labor is of outstanding importance. In some industrial centers it is less serious than in others; it is more of a problem for some industries than for others. But it is unquestionably a limiting factor, in production and in employment, and it must be reckoned with in any forecast of the future.

Despite all our planning economic laws refuse to be circumvented. Continued labor shortages always force wage rates upward, as is the case today. But if prices rise correspondingly the peak of the upward swing will soon be reached and we shall be headed for a new depression valley. For this reason wise management will do everything possible to reduce production and selling costs in order that the final price to the consumer, domestic or industrial, be as low as possible consistent with a reasonable profit.

As labor costs rise, some counter effect may be obtained through introducing new machine equipment and replacing obsolete units. A movement in this direction developed strongly during 1936, as evidenced by the steady upward trends of the *American Machinist* Index of Industrial Machinery Sales and of the machine tool orders index of the National Machine Tool Builders' Association. The movement will continue in 1937 and will aggravate an already difficult delivery situation. Orders must be placed at once if the customer expects to get much good out of new machinery this year.

For the past decade the trend of obsolescence in metal-working equipment has been upward—44 per cent in 1925, 48 per cent in 1930, 65 per cent in 1935. At the time *American Machinist* made its 1935 survey it was estimated that the machine tool industry would have to operate at a rate corresponding to an index number of 107 to keep the obsolescence rate from rising further. To recover the ground lost from 1930 to 1935, the rate of activity was estimated at 179 for a five-year period. What has happened?


METAL TRADE EMPLOYMENT
Per Cent of 1925-1927 Monthly Average
High Cities
Worcester 111.4
Hartford 107.4
Cincinnati 131.9
Columbus 108.9
Milwaukee 126.2
Canton 128.6
High Industries
Iron and Steel 181.2 Foundries and Machine Shops 91.3
Machine Tools 117.7 Stamped and Enameled Ware 120.8
1929 1930 1931 1932 1933 1934 1935 1936
INDEX OF ORDERS FOR MACHINE TOOLS
Obsolescence
1919 '20 '21 '22 '23 '24 '25 '26 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36
INDEX OF INDUSTRIAL MACHINERY SALES
Factors: Machine tools, Electric motors, Boilers, Foundry equipment, Woodworking machinery, Air conditioning equipment, Industrial pumps
Average month 1926-'27=100
1926 '27 '28 '29 '30 '31 '32 '33 '34 J F M A M J J A S O N D J F M A M J J A
1935
1936
BANK CREDIT SITUATION
Million Dollars
Bills discounted (daily averages)
Member Bank Excess Reserves (daily averages)
1918 '19 '20 '21 '22 '23 '24 '25 '26 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36

In 1935 the average was well below 100, but there was a sharp improvement in 1936 and the index reached 150 for July and 147 for November. Incidentally, the average for 1929 was 155, only five points above the high month of 1936. If this trend continues we may look for some improvement in 1940 over the very bad obsolescence level of 1935.

It used to be believed that sales of industrial machinery started to decline long before the accepted indicators of business activity showed that there was trouble ahead. Also, that recovery in the machinery industry lagged far behind that of the business structure as a whole. Careful studies indicate that the two travel along together with remarkable faithfulness, rising together and falling together, but not at the same rate, of course. Fluctuations in the heavy industries have always been far wider than fluctuations in the consumer goods fields, and probably always will be.

The metal-working industries, therefore, may well keep a careful eye on the major business trends, and expect to be affected by them as they develop. If we look back over our business experience of 150 years we find that there was a short primary depression following each major war, then a brief period of activity, and then a prolonged secondary depression, becoming longer and deeper as the capital goods industries became a more and more important factor in our mode of life.

Another fact is evident from a study of these earlier depressions. When the tide finally turns and the cycle swings from depression to recovery, the direction of the index curve is sharply upward and continues with a momentum that lasts for many months. It is this momentum that will help us in 1937, for we have not crossed the normal line dividing depression from recovery. *Business Week's* index, which is based on a calculated normal that allows for population growth and other long-time factors, is still between 15 and 20 points below normal. It may be expected to carry on to well above normal before we need look for any falling back.

Inflation Possibilities

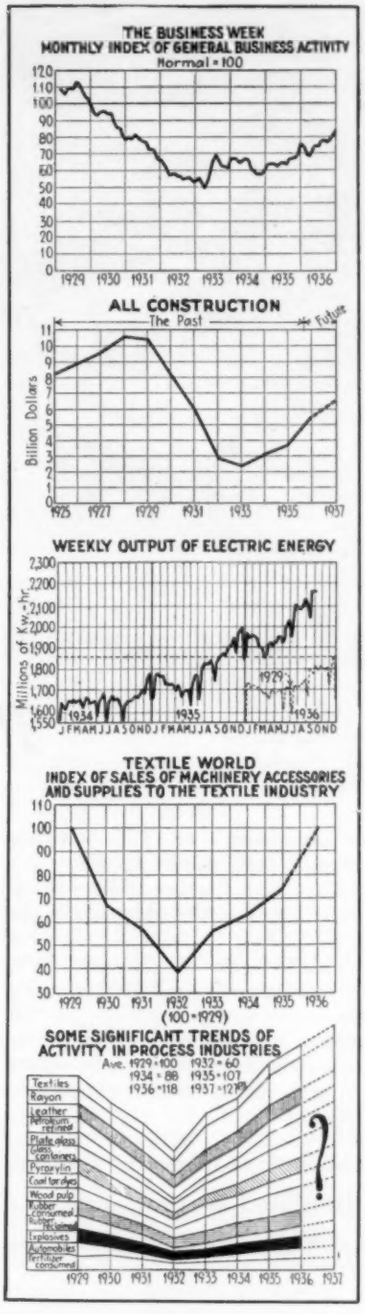
One more major factor that will affect activity in all industry in 1937 is the potential credit inflation possible with the enormous reserves now in our banks. The banks are about five billion dollars better off than they were in 1921. Fifty billions of bank credit could be created on this base almost over night, and in an emergency further vast expansion would be possible. The effect of such an expansion would be to swamp the machinery building sections of the metal-working industry immediately, and the rest of it very soon after. The problem is how to keep the inflationary forces in bounds.

So much for general factors affecting all markets. Let's look at some typical individual markets.

In the transportation field each of its major divisions promises to be a better market in 1937 than for several years. The railroads are buying motive power and rolling stock, and have made substantial appropriations for rebuilding programs in their own shops. Most of them are experimenting with the new light weight equipment. When a bit more experience with its maintenance is at hand there is sure to be revolution in back shop methods and equipment.

Likewise, the accelerated schedules on all main lines, for standard as well as stream lined equipment, are going to demand better maintenance than any we have been accustomed to.

Unless labor disputes cripple it, which does not seem likely even in view of the soaring ambitions of John Lewis, the automobile industry is going to sell more automobiles and buy more materials, parts and manufacturing equipment than it has ever done before. It is a good guess that if labor trouble slows down production during the first quarter, schedules in the second quarter will have to be stepped up to meet the demand.



In the construction field experience shows that about two-thirds of every dollar spent gets back to the material and equipment suppliers. Hence an increase of contracts to something over six billions, which is the current estimate for 1937, means substantial business for metal-working companies that supply this field. A decidedly healthy trend is the steady drop in the share of the contracts placed by government, and the corresponding increase in private enterprises.

During the last few weeks output of electrical energy has set new all-time records. Most of the generating stations are at or near capacity. As the demand increases in 1937 new stations must be built and existing ones enlarged. Commitments for 1937 are something like 2,500,000 kw., or, at $100 per kw., $250,000,000. This is exclusive of commitments for transmission. Electrical manufacturing in 1936 approached the 1929 level and should equal or surpass it in 1937. Appliances are far ahead of the 1929 record and should widen the gap.

The textile industry had the best year in 1936 that it ever had. Textile mill activity stood at 125 as compared with 115 for 1929. *Textile World's* index of sales of machinery, accessories and supplies to the textile industry, which dropped to 39 in 1932 has recovered to 100 on the 1929 base, and is expected to stay there or climb further.

For real activity, now and ahead, we must turn to the process industries. A composite index for 14 of them, including rubber, explosives, leather, glass, paper and rayon hit 118 in 1936, promises to reach 125 in 1937. New construction in the chemical and process industries is going like a house afire.

Adverse Factors

And so we might run through the other markets for the products of the metal-working industry. We should find a promising picture all along the line. To offset it to some extent we have a stupid tax law which may not be amended as much as it should be, and we have a new Congress that may do almost anything. We have the honest unemployed, and we have a constantly growing army of professional unemployed, organized in unions and ready to use every racketeer's trick to keep themselves on the government payroll.

Strict neutrality, if we can invent a way to get it, will save us from a part in a world war. An intelligent approach to industrial relations will help to lessen the damage from strikes and internal warfare. A most hopeful sign that we are waking up to what might be done to improve industrial relations is what is being said by industrial leaders in conventions and in statements and articles. We can do no better thing for ourselves and our country in 1937 than to try our best to improve the relations between management and men in industry.

Europe Manufactures *Planes*

S. PAUL JOHNSTON
Editor, Aviation

Inspection of airplane and motor factories in Europe discloses an industry — war stimulated — that outranks our own as our automobile industry dwarfs that of Europe

SINCE the close of the war of 1914–18, the rise of air power has changed many tactical concepts. Although no future war will ever be fought entirely in the air, it is plain that great masses of aircraft will be employed. Where generals fifteen years ago thought of aerial attacks in terms of ten or twenty machines, future commanders must be ready with hundreds, if not thousands. Thus, the wars and rumors of wars that have been running rife in Europe in the last two years have resulted in the construction of aircraft on an unprecedented scale.

In the course of a recent trip abroad I had an opportunity to see something of the great aircraft production activity in England, Germany and France that has resulted. The survey, although brief, yielded a number of clues as to the general state of affairs in the factories of those three countries.

England, reluctant to participate in an air armaments race—hopeful that the trend of affairs in Europe would not require it—held off building up her armament to full war-time strength until about a year ago. Sensing that further delay would make her position dangerous, she went to work to build an air force second to none in Europe. Now, with less than a year of the expansion program behind, some of her factories have settled down to orderly production on a large scale; others are still rather badly disorganized but are now in the process of getting squared away for real production.

First requirement of the expansion in individual factories was new building. Aircraft manufacturer needs considerable floor space. But there is quite a difference between the area required to turn out planes at the rate of one or two a month, and the present necessity of getting through one or two a day. Actually, demand for production rose so rapidly in certain places that production was literally pushed out of doors. At one place in particular, workers were seen putting together assemblies and subassemblies, and even painting small parts, out in the open air, while construction gangs were laying floors under their feet and throwing steelwork across overhead for new roofing. Draftsmen, clerks and other employees have been moved into larger quarters while plasterers, carpenters and electricians work right along with them to complete the buildings.

The situation has created a rising market for machine tools. New lathes, drill presses, boring machines and grinders are being moved into place and put to work as soon as they can be connected up to power supply. Many American tools have been purchased. At one plant a half-dozen Berliner propeller profiling machines, built in the United States, were being installed and familiar name plates are to be seen here and there.

Airplanes must have engines, and the British motor manufacturers have been pushed to capacity to keep up with aircraft production. Generally, British engines require more machining operations than do American motors of corresponding size. For example, on an engine now in mass production, cylinder heads which here are made of cast heat-treated aluminum alloys are machined out of solid forgings. A radial engine cylinder

head with all its complicated fins, valves, intake and exhaust ports and spark plug openings, is no simple thing, and a vast amount of machining is necessary to "hog" the finished article out of the solid forged block.

Certain English manufacturers are building American designed parts and accessories, under license. This has required the installation of a large number of machine tools at production centers. The British licensee building Hamilton Standard controllable pitch propellers is just getting its factory set up. At present it is said to be producing three or four large three-bladed assemblies per day, and is expecting to turn out propellers at an increasing rate in the future.

One of England's chief concerns recently has been the setting up of the so-called Shadow Scheme, a plan for decentralizing a large part of the aircraft industry by setting up the manufacture of parts in scattered non-aeronautical plants, and assembling units at some central point. The present manufacturers of aircraft and engines remain as the basic industry but behind them is the "shadow" industry which will provide for expansion in emergencies. Designs for the planes and engines will originate with the aircraft people, but the parts production may be farmed out to any plant that can provide a nucleus of the proper tools and of trained personnel. In peacetime production will come chiefly from the basic plants, with only enough in the way of orders allocated to the shadow plants to keep the personnel and tools in shape to go into high production on demand.

In going through English plants one is struck by the large numbers of young boys at work. Hundreds of youngsters between 12 and 14 are now serving their time as apprentices in the aircraft factories.

German Mass Production

German aircraft factories are a striking contrast to those in England. Where England is still in the throes of bringing her production facilities up to high level, Germany has obviously left that period well behind and is now set up to turn out aircraft smoothly and efficiently on a tremendous scale. Certainly the new Junkers airplane factory at Dessau, the modern engine plant at Küthin, and the new Henschel factory at Berlin may safely be ranked among the most beautiful plant layouts in the world. Their tooling equipment is modern, efficiently laid out, and excellently maintained. Parts and materials move smoothly and continuously from receiving departments through to final assembly, and the planes and engines roll out of the doors seemingly by the simple process of turning a crank. In Germany they have not quite reached the stage of automatic assembly lines on the Ford plan, but probably more than anywhere else in the world they are approaching it.

One problem facing plant layout men in Europe that we know little about in the States is the protection of plant and personnel against bombing raids. Everyone in Europe is acutely aware of the fact that the first move of any new war will be mass bombing of key industries. Concessions have had to be made, therefore, for protection. Where we would develop a building site to its fullest extent by a compact and orderly arrangement of the buildings on it, there the new plants have been deliberately scattered over many acres, with the buildings widely separated and with no two units in parallel alignment. Thus a falling bomb may damage one building without doing harm to its neighbors.

Buildings Scattered

The new Henschel plant on the outskirts of Berlin is an excellent example of this type of construction. Not only are buildings scattered at Henschel's works, but all windows are provided with screens that may be closed at night to prevent light from showing on the outside, and furthermore, each unit is provided with bomb-and-gas-proof cellars in which the workers may seek protection in case of a raid. These dugouts are provided with gas-tight doors and fitted with auxiliary ventilation. They contain ready - for - use chemically-treated overalls and gas-masks for the plant personnel.

Germany, probably better than any country in the world, looks after the health and welfare of its factory workers. Socialized medicine seems to be in force, and many plants are fitted up with elaborate clinics not only to render first aid in case of accident, but also to guard the health of the employees. The theory is, of course, that it is cheaper in the end to keep employees well than it is to pay the bills for lost time through illness. At Heinkel's plant in Rostock, an elaborate system of curative baths has been installed, complete with trained attendants, where any employee may go for a cure if he feels the least bit "under the weather." Workers are urged not to wait until they are definitely sick, but to come to the clinic for examination and treatment at the first sign of trouble. Similarly, Junkers at Dessau and other plants all over Germany not only maintain clinics but provide excellent housing and recreational facilities for employees.

Conditions as seen in a number of French plants appear definitely bad as compared with England and Germany, and fall far short of standards common in this country. There are exceptions, of course, but the general impression given is of unnecessary crowding, lack of proper light, poor heating and ventilating, and terrible sanitation. In several engine factories visited, machine tools are crowded closely together, row after row, with narrow aisles. Practically all are belt driven from overhead shafts. The forest of driving belts quite effectively cuts off most of the light that filters in through grimy windowpanes overhead. The shafting for each block of machine tools is driven by a discouraged looking electric motor of uncertain vintage, connected to the power supply through a weird and wonderful system of loose wiring and open knife-switches that would give the average safety and fire inspector a bad case of the jitters. In many plants the only heating comes from pot-bellied cast iron stoves, burning coal or coke, delivering an uncertain quantity of heat to the immediately surrounding atmosphere.

Large numbers of women workers are in evidence, apparently ranging from ten to fifteen per cent of the total employed. Nor are they engaged entirely in light jobs. In many cases they are working side by side with men on lathes, grinders, drill presses and other relatively heavy machine tools.

30,000 War Planes

Although time did not permit visits to either Russia or Italy, there is plenty of evidence that their manufacturing industries are booming on the same scale as the rest of Europe. Russia has announced her intention of outbuilding Germany in aviation, Italy has been on a war-time footing for well over a year. It is a fair guess that the major powers of Europe have somewhere between 25,000 and 30,000 aircraft on hand at present. If production continues at current rates, the number may easily be doubled by the end of 1937.

Light of Last Century

ROGER C. DICKEY
The International Paper Box Machine Company

Good shop illumination, considered so essential today, was unknown to the craftsmen of the past generation

IT WILL always remain a mystery how the machinists in the early eighteen hundreds obtained the necessary light to do their work. It is a certainty that the only artificial light available at that time was candle light, and the feeble, yellow rays they gave make the work all the more amazing.

The modern machine shop had its origin in the early blacksmith shop. Here with forge, anvil and hammer, the smith heated the iron to the proper color and hammered it into the desired shape. Then it was tempered by plunging it into water.

The architect of the blacksmith shop seems to have overlooked the necessity for windows, perhaps because the prevailing smoke soon left them translucent. But every blacksmith shop had a door, large enough to allow a good sized wagon to be driven in. Through these open doors sufficient light filtered to enable the blacksmith to work.

As New England craftsmen began to build carriages in sufficient volume to supply the early colonists with conveyances, carriage shops were built in conjunction with the blacksmith shops. These shops were combinations of woodworking and machine shops, and we can judge from those still standing today that ample window space was provided.

The textile mills began to expand during the early part of the nineteenth century, and as there were no machine shops adequately equipped to meet their needs for machinery it was customary for each textile mill to have its own. Here architecture stepped in to a certain extent, and the lofts of the mills were equipped with skylights where the finest work was done.

Daylight to Dark

The machine shop, as well as the entire mill, worked from daylight to dark. In the summer the hours were from six in the morning until six at night, gradually shortening until in the winter work was stopped at four-thirty, simply because the men could no longer see.

These early machinists were recruited from among the huge English weaving centers and were highly respected members of the community. In every New England village there was a common meeting house where the entire population was expected to gather on Sunday, not only to hear the preacher's interpretation of a sulphuric Hell, but to swap horses and gossip.

Each Monday morning the officials of the mill posted the names of all the workers who attended the Sabbath services, and proud was the department having a perfect attendance. It was the purpose of each machinist to secure a perfect record for his department.

So for nearly half a century machines were built by natural light. Then the brave maritime men of New Bedford introduced a new lighting fluid; sperm oil, which they obtained from whales in the seven seas, was universally accepted as a lighting fluid, and whale oil lamps were placed in machine shops, in positions most advantageous. For assembling rooms the "petticoat lamp" was developed. This lamp was made of brass and measured six inches high. At the top were two short protruding tubes through which ran small wicks. The upper three inches of the lamp formed the oil container which was round. The lower portion of the lamp spread out like an old-fashioned petticoat so that it would not tip over easily.

The next step in illumination arrived with the acceptance of gas as a lighting medium and which Fred H. Colvin recently described (*AM*—Vol. 80, page 577). But the whale oil "petticoat lamp" continued to be used because it was impossible to convey the gas light beneath machines and in difficult places. These lamps were used until the advent of kerosene as an illuminating oil.

It's no mean job to pick the electrical equipment best suited to a particular machine shop application

Motors for Machine Tools

W. M. RIDGEWAY
Electrical Engineer
Ingersoll Milling Machine Company

R. S. ELBERTY
Machinery Electrification
Westinghouse
Electric & Manufacturing Company

APPLICATION of the correct electrical equipment for machine tool drive generally requires that a choice must be made between several alternate solutions of the problem. Questions that commonly arise when a selection of the best drive is being made are—How is motor horsepower for an intermittent or varying load determined? When should short-time rated motors be used? Should the motor be totally inclosed, semi-inclosed or open?

There are widely divergent opinions relative to the degree of motor inclosure required on various machine tools. One automobile manufacturer uses totally inclosed, fan-cooled motors; another has standardized on the splash-proof motor. The conditions under which the machine tool will operate determines the type of motor inclosure to be used. One lathe builder had always used standard open motors without any difficulty, until several machines were installed in a middle west community where dust storms were prevalent. The motors clogged up with dust and were replaced with totally inclosed, fan-cooled motors which eliminated the trouble.

Westinghouse Practice

In Westinghouse Electric and Manufacturing Company plants, most a.c. motors are standard open motors. For machines located in the various foundries and in extremely dusty places, totally inclosed fan-cooled motors are used. D.c. motors are semi-inclosed, drip-proof on the commutator end, except when totally inclosed fan-cooled motors are used. Motors are given a casual inspection about once a month, and motor trouble is practically nil.

The matter of motor torques determines the starting and maximum overload capacity of the drive. A.c. squirrel cage motors may be wound with a wide range of starting torques, from the low starting torque motor sometimes used on grinders to the high torque, high slip motor used on flywheel machines. The type of motor governs the performance of the drive, and special performance characteristics can be obtained to meet machine requirements. On some small motors 12–15 reversals per min. can be obtained, and special reversing motors to furnish as many as 60 reversals per min. are coming into common use for tapping duty.

R.M.S. Horsepower Basis

In many cases, the size of motor to apply may be determined from experience gained from similar machining operations. For intermittent or varying loads, the heating in a motor caused by "copper losses" will vary as the square of the motor amperes. Since motor amperes vary approximately in proportion to the load, root mean square horsepower is ordinarily used as a basis for selecting the proper rating of motor for intermittent or varying loads.

When the maximum horsepower required on an intermittent duty cycle exceeds the overload capacity of the motor selected on an r.m.s. horsepower basis, a motor with a rating that will carry the maximum overload must be selected. For this class of service, a motor with a short-time rating might be used. Short-time rated motors are also used where the motors are operated intermittently. Short-time rated motors may be obtained rated 1 hour, ½ hour, ¼ hour and 5 min. The electrical power obtained from a 5-min. rated motor just about matches the mechanical strength of the motor and shorter time ratings than 5 min. are not ordinarily considered practical. Short-time rated motors cost from two to five per cent less than standard ratings and may be one or two frame sizes smaller depending on the rating.

There are many advantages to be gained by actually including the motor and control equipment as an integral part of the machine tool. A consideration of the many possibilities of the electric drive indicates that this important part of the machine should be considered right from the start of the design. The variety of such applications makes it hard to develop general rules for the application of electrical equipment, but a review of what is being done might point the way for further progress.

Mechanical modifications of electric motors may be used to good advantage in fitting the motor to the requirements of the machine. In many cases, the added cost of the mechanically modified motor is more than offset by the savings in machine cost. In this same connection, there are many applications where a built-in motor is desirable. The cost of such an application should be justified by the improved performance of the machine. In general, the built-on or flange mounted motor will show a lower cost than the built-in motor.

Anti-friction Bearings

The machine tool industry uses about an equal amount of ball and sleeve bearing motors. Some grinder manufacturers insist on sleeve bearing motors claiming that a better finish is obtainable. There are other grinders that use ball bearing motors.

On machine tools using anti-friction bearings, the tendency is to apply ball bearing motors. Ball bearing motors are necessary where motor is mounted at an angle or in a vertical position.

Dynamic balance of motors is becoming of increasing importance. No standard method of determining dynamic unbalance of a motor has been determined. Usually unbalance is specified as a maximum vibration of the motor frame with the motor resting on a flat plate and running idle. With the extra charge made by electrical manufacturers for dynamic balance, a balance as fine as 0.0002 in. vibration of the motor frame can be specified. On integral horsepower and larger motors, balances as fine as 0.0001 in. can be obtained at double the normal addition price for dynamic balance. Many motor manufacturers dynamically balance motors that operate above 1800 r.p.m. as a part of the standard manufacturing procedure, but this operation does not insure that the degrees of balance mentioned above can be obtained.

Machine tool designers show a definite trend in taking the lead among machinery manufacturers in the application of electric drive. Successful application of electrical apparatus to machine tools requires a complete understanding of the requirements of the specific tool and a knowledge of the characteristics and limitations of electrical equipment. Close cooperation between the mechanical designer and the electrical engineer while the machine is in the design stage will result in a balanced machine, wherein the electrical drive becomes an integral part of the design.

DRILLING CYCLE

Operation No.	Time Minutes	Drive Hp. Load	Motor Speed	Effective Time	$Hp.^2$ x Time	Traverse Hp. Load
1 Start	.....	..	....	.....	.....	...
2 Advance	0.05	3	3450	0.05	0.45	2.2
3 Drill No. 1 and No. 6	0.742	15	3450	0.742	167.0	0
4 Return	0.05	3	3450	0.05	0.45	2.2
5 Standstill	1.1	0	0	0	0	0
6 Start	.....	..	....	.....	.....	.....
7 Advance	0.05	3	3450	0.05	0.45	2.2
8 Drill No. 2	0.75	8	3450	0.75	48.0	0
9 Return	0.05	3	3450	0.05	0.45	2.2
10 Standstill	0.1	0	0	0	0	0
11 Start	.....	....	....	.....	.....	.....
12 Advance	0.05	3	3450	0.05	0.45	2.2
13 Drill No. 3 and No. 4	0.742	15	3450	0.742	167.0	0
14 Return	0.05	3	3450	0.05	0.45	2.2
15 Standstill	0.7	0	0	0	0	0
16 Start	.....	..	....	.....	.....	.....
17 Advance	0.05	3	3450	0.05	0.45	2.2
18 Drill No. 5	0.75	8	3450	0.75	48.0	0
19 Return	0.05	3	3450	0.05	0.45	2.2
20 Standstill	0.1	0	0	0	0	0
Repeat.						
Total	5.384	..	....	3.384	433.60	.....

$$R.M.S.\ hp. = \sqrt{\frac{\Sigma\ (hp^2 \times \text{time})}{\text{Eff. time}}} = \sqrt{\frac{433.6}{3.384}}$$

$$= \sqrt{127.5} = 11.3\ hp.\ \text{(drive motor)}$$

For traverse motor, r.m.s. Hp.= 2.2

The above drilling cycle is performed by an Ingersoll Power Pack. The machine uses a 15-hp., 3600 r.p.m., 1 hr., 55 deg. totally inclosed fan-cooled main drive motor and a 2.2 hp., 1800 r.p.m., 10 min. 55 deg., totally inclosed traverse motor. Both motors are built into the machine.

MACHINING CYCLE

Operation No.	Time Minutes	Hp. Load	Motor Speed	Effective Time	$Hp.^2$ x Time
1. Run Idle	0.455	1–1/2	1760	0.455	1.02
2. Bore	1.0	44	1760	1.0	1936
Total	1.455	....	....	1.455	1937.02

$$R.M.S.\ hp. = \sqrt{\frac{\Sigma(hp^2 \times \text{time})}{\text{Eff. time}}} = \sqrt{\frac{1937.02}{1.455}}$$

$$= \sqrt{1332} = 36.4\ hp.$$

An Ingersoll boring machine has a typical duty cycle as shown. This machine was equipped with a 40-hp.,1800-r.p.m., continuous 55 deg., totally inclosed, fan-cooled motor.

MECHANICAL MODIFICATIONS FOR A.C. MOTORS

Modification	Price Change
Ball bearings	+ 5%
Semi-inclosed	+ 7 1/2%
Drip proof	+ 71/2%
Totally inclosed fan-cooled	+ 66%
Dynamic balance	+ $7 to $16
Flange mounting	+ $11 to $57
Round frame	+ $3 to $27
Vertical	+ 25 to 25%
Low starting current	+ 5%
High starting torque	+ 7 1/2 to 15%

Approximate price additions for mechanical and electrical modifications of a.c. squirrel cage motors.

SHORT TIME MOTOR RATINGS

Time Rating	Full Load Operation % Total Time	Maximum Operating Time at Full Load	Maximum Torque % of Full Load	Starting Torque % of Full Load
1 hr. 50°	50	1 hr.	Same as standard rating	
1/2 hr. 50°	30	1/2 hr.	275–300	275–300
1/4 hr. 55°	19	1/4 hr.	275–300	275–300
5 min. 55°	8	5 min.	250	250

A chart giving a basis for the application of short time rated motors. If the motors are applied on the basis that they carry 150 per cent load, the time values shown in the table must be reduced by one-half.

The Tool Designer *and His Tools*

I—The first article of a series discusses the general approach to the problem of engineering jigs and fixtures for shop operations.

C. W. HINMAN

A GENERATION ago the designer fought his way through many an intricate mechanical design without the aid of present-day research, charts and handbooks. His methods in design were too often those of chance, a fond hope that a fortunate "cut and try" method in the shop might save the day. These methods are in reality no method. Even today, scientific research in mechanical design is a subject still in its infancy.

A tool design may appear highly practical, promise much on paper and then utterly fail to function when materialized and tried in practice. The design may be based on correct fundamental principles, but if details are incorrectly developed, either on the board or in the shop, there is trouble ahead. A poor design well worked out is often better than a good one in which important details are slighted. Successful designing is, therefore, a science and will be so treated in this series. Today everyone knows that science is in the vanguard, leading the march of most professions; why then do we not use it more in solving the major problems in tool engineering and construction?

To Stress Principles

These articles propose to give many of the principles in past and present design, and to present practical applications of them. Mechanical principles will be stressed in preference to subsequent performance. Obviously, if the design is correctly developed the finished product will be right. An effort will be made to satisfy the beginner, to aid the advanced designer and to introduce interesting ideas for the professional. Mechanical designs are often determined by one or more persons in authority and then developed by the designer. It is unimportant who discovers a design. The important thing is the basic principle best suited for solving the problem.

The best designer is usually the one who has considerable aptitude for the work. However, those without this ability often master the vocation by study and daily experience. On the other hand, one who has a proclivity for things mechanical often spends a life-time in a different calling. This would indicate no fixed rule; anyone who can analyze details, is fairly good in mathematics and has a practical sense of size and proportion can develop proficiency in this profession by continued application. Education should be equivalent to a high school course, or better. Many young women have become excellent tracers of tools and machinery in some engineering offices. Artistic technique is desirable but unnecessary in tool engineering. It is an important gift, however, in product designing where a strong appeal to the buying public is essential. Draftsmen with shop training soon become good designers if well versed in shop mathematics and if their shop experience has not been too prolonged. Technical graduates seldom follow the designing profession permanently; they usually change to executive positions, teaching or salesmanship.

Selecting the best drafting equipment is important; there is no economy in purchasing cheap academic drawing sets. Instruments with well-rounded corners have the right "feel" and for this reason are easiest to use. A bow compass with the center wheel mounted on right and left hand Whitworth adjusting threads is best for fast work. This compass can be speedily adjusted in one hand, and the Whitworth rounded threads are seldom stripped by wear. All working parts in drafting instruments should be oiled occasionally.

It is unnecessary to review the many advantages in using a good drafting machine. With less tools or other objects on the board, speed is materially increased. Drafting machines eliminate T-squares, triangles, scales and protractors; they save much of the designer's drafting time, especially when drawing details. Draftsmen's kits are incomplete without half and full size scales, a decimal scale, several irregular curves, a beam compass and a good handbook or two.

Fastening Drawings

Using Scotch drafting tape for securing drawings on the board, has a decided advantage over the use of thumb tacks or staples. It offers no obstacle to the movements of T-square or triangles; they slide over the taped edges of the drawing without interference. In using this tape, no tack holes are made in the board. In fact, by its use, a steel top drafting board would be practical. The heavy paper cover used under the tracing could be secured by front and rear pivoted yokes, the same as used for holding the tympan on the platen of a printing press.

Another convenient way to fasten drawings is by using steel wire staples which are inserted through the paper and into the board. The staples can

be easily removed with a blade. A vertical "hand stapler" is all that is necessary for inserting the staples, and in using them there are no interferences on the paper surfaces.

During the World War, the large demand for quick mechanical construction practically abolished the use of India ink drawings on tracing cloth, except for standard designs and permanent records. White or buff tinted vellum, Sterling grade, or the more durable pencil tracing cloth, is now universally employed in rendering mechanical drawings. Pencils used are 1H, 2H and 3H in hardness; the first two for lettering, and the latter for line drawing. Hard leads, 6H and up, are used for precision layouts. Drawing paper is a matter of individual choice, but is an unfortunate choice if the paper adopted allows pencil lines to wear off or blur, or makes it difficult to erase lines without rubbing through. A Lumograph pencil especially designed for tracings is now obtainable. It holds its point well, and the lines produce clear cut prints. If tracing powder is well "rubbed in" on the vellum, the paper will "take" the pencil better, and subsequent alterations are easier made. After erasing, the powder should again be lightly applied.

Preliminary Steps

The first procedure in design is to get an originally right conception in detail of what the proposed tool or machine is expected to do. If the design is intricate, write in sequence the order of operations. If it is an unusual design, make copious free hand sketches of its outstanding features, or the "heart" of the device, before starting the drawing. Make the first drawing on opaque paper, in light lines, suitable for changes and for a subsequent vellum tracing; continue this process until the principal features are practically worked out. Add to the original conception your improvements—movements or working members—that help to accomplish the expected result and eliminate all features that interfere.

If troublesome conditions appear, such as limited space for necessary working parts, or other interferences unfavorable to a successful layout, then by reversing the conditions you often succeed in making bad conditions aid you. For example: A press tool design may appear impractical until you look at the drawing from the top down. Turning the drawing upside down will often suggest that the well-known "inverted die" is more practical, in which the die block is the upper, or moving member, and the punch below is the stationary member. In another example, a rotary cylindrical brush drum was employed for passing along the parts in a chute which fed an automatic machine. It failed to function by a one-way continued rotation, because it caused the work to interlock and "stick" in the chute. This device was about to be discarded as a failure when it was discovered that if the drum was made to rotate one revolution backward, then one forward, it functioned perfectly. The reversed revolution untangled the work pieces, and the forward revolution fed them properly. Therefore, when in doubt about using any mechanical principle, movement, or working member, first ascertain in how many different ways the thing can be made to perform, move, or function, and then discover which one of these ways may be made to fulfil conditions.

The most practical way to fabricate the parts and to make assemblies is similarly determined: by assuming several proposed methods in freehand sketches, and then selecting the best; by having a knowledge of modern machine tool performance; and by knowing just how the work can be done, and the shop equipment available for doing it. Sometimes it is better to send the work to outside shops, where the equipment is better suited for particular work. This process of reviewing all the possible movements and construction methods in machine design is a part of scientific classification, a frequent path toward successful designing.

Rotation and Reciprocation

Designing is often simplified by recalling the fact that there are only two primary mechanical movements, namely, rotary and reciprocating, and that each in turn can easily be made to reproduce the other. For example: The rotating crank in a punch press is made to reciprocate the tool slide up and down by means of a driving arm connection. In a gasoline motor the same conditions are reversed, and the slide, or piston head, in moving up and down, is made to rotate the crankshaft by means of connecting rods.

Rotary and reciprocating motions are sometimes made to merge if necessary, for instance, when a roller is attached on a fulcrum lever and is made to follow in an irregularly shaped cam slot. The contour of the slot can be designed for the purpose of guiding the roller into a variety of geometrical movements, circular arcs, spiral sectors, parabolic curves, elliptical paths, angular directions, or in irregular sweeps, for many special purposes. A nut following on a lead screw, in principle is the same as a "follower" in a long uniform slot cut in a cylindrical cam. The nut converts rotary motion into a straight line direction.

The Starting Point

Many tool and machine designs are simply a symmetrical layout of parts around a common center line. Even a complex machine is generally a series of interdependent units, each of which is a symmetrical layout of parts around a common point or individual center line. Designing appears more simplified when this common center line principle is kept in mind. Starting with this line, the parts can be symmetrically designed around it. There are special cases, however, where this cannot be done, as in a forming die for an unsymmetrical piece. In such instances a vertical and horizontal working line, within or outside the piece, can be established. This subject is treated at length in a future article.

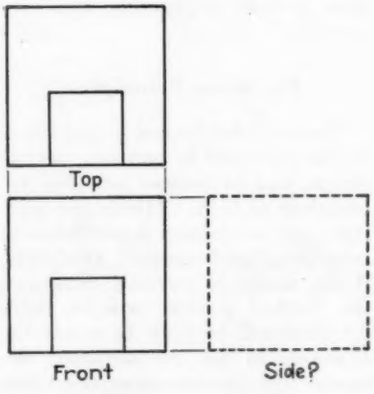
Part II of Mr. Hinman's series, to appear in an early number, will deal with shop mathematics.

A Drawing Puzzle

J. E. MOORE
Wichita High School East

MY STUDENTS "stumped" me with the drawing problem shown. The top and front views were given me, and I was asked to finish the side view. The boys let me puzzle over the problem for two days, and then showed me how it was done.

Can you finish the problem?



Safety First in
Locomotive Maintenance

Failure prevention begins with the shop's skill in fabricating key parts

FRED H. COLVIN
Editor

SAFE travel, of which the railways are so justly proud, involves many phases of railroading. One important factor is the safety that has been built into the locomotive itself. Boiler explosions have become almost unknown. Connecting-rod and side-rod failures, which caused many derailments in years gone by, are a thing of the past, because of the increased knowledge and care exercised in the selection of steels and their heat-treatment.

An indication of the care that is being taken is shown by the practice of the Delaware, Lackawanna & Western Railroad at the Scranton shops. Carbon-vanadium steel main and side rods are used on this road, and the first step in forging them is to preheat the billet from 900 to 1,100 F. in a furnace. The billet is then placed in a large furnace and brought up to 2,100 F. for forging. Care must be exercised in forging the rod as it gradually loses heat. When it gets to about 1,700 F. it is again put back in the furnace and brought up to the higher temperature once more. This procedure is continued until the forging is finished.

After rods have been forged, they are again heated to 1,300 F. and taken to the flame-cutting machine. Here the rods are set up one at a time on the table and cut to the desired shape. In this setting-up operation the temperature drops about 100 deg. F., and thus the forging is cut when the temperature is about 1,200 F.

After the rods have been flame cut to shape they are placed in the heat-treating furnace which is controlled by a master recording pyrometer. A temperature of 1,600 F. is used and the heating period is determined by allowing one hour per inch of thickness. Rods are then removed and allowed to cool in still air.

To draw the rods they are again placed in the furnace and held at 1,200 F. for a period likewise determined by the allowance of one hour per inch of thickness. They are left in the furnace to cool. After this heat-treatment a coupon is cut off the end of the rod and sent to the laboratory for physical tests and micro photographs. The chart covering the heat is sent along with the coupon to the laboratory.

If the coupon shows satisfactory physical properties and micro-structure, the rods are released from the smith shop, and serial and heat numbers are stamped on each for identification. They then go to the machine shop. Should a rod fail in service, the serial and heat numbers can be obtained readily and the records checked.

This care in handling both main and side rods does not end when new ones are put in place on the locomotive. Whenever the locomotive comes in for general repairs all rods are given a normalizing heat as part of the job. This treatment removes stresses caused by vibration and fatigue and restores them to their original safe condition.

A similar procedure is followed with all spring rigging members. These include spring rigging, hanger hubs and hangers, all of which are normalized after being reconditioned. Hub hangers and spring hangers are now made in one piece on heavy forging machines to remove the possibility of failure. There are surprisingly few failures in any of these parts.

Mechanical stokers are now such an important part of modern coal-burning locomotives that failure of any of their mechanisms must be guarded against so far as possible. To prevent failure and forestall train delays because of steam failure, both the engine and tender units are completely removed when the locomotive comes in for repairs. The stoker units go into the large lye vats for thorough cleaning, after which they are dismantled and thoroughly re-

paired. New parts are supplied without question where necessary. If worn surfaces can be renewed economically and safely by building up with the welding process, this method is used to expedite repairs.

Suitable stands are provided for these units to enable the workmen to get at the various parts easily. The operation of the stokers can also be tested while on these stands and before they are put in place in the locomotives.

Use of solid or floating bushings began with side rods and has been replacing the old two-piece, keyed brass over a long period. The use of solid end rods has been credited with eliminating many accidents arising from side rods being broken through errors in taking up the rod brasses. With keyed brasses it was easy to set the rod up with the center distances either long or short. In either case there is undue strain on both rod and pins. This chance of error is removed by the solid end rods and floating bushings in side rods, and is now common practice to a large extent in the back end of the main rod.

On most railways, however, the front end of the main rod, where it bears on the crosshead pin, is still a two-part, adjustable bearing. Numerous attempts have been made to use solid bushings here, but most of them seem to have been abandoned. The Lackawanna railroad has, however, succeeded in making solid front-end main rod bearings practical. They have replaced the old two-piece bearing and removed a more or less constant source of trouble of adjustable bearings working loose and causing engine failures.

The Lackawanna railroad has found that the success of the solid bushing in the crosshead end of the main rod depends almost entirely on proper lubrication. By having the wrist, or connecting-rod pin drilled or hollow-bored, the lubricant can be forced to the bushing through holes from the cavity in the center of the wrist pin. A soft grease has been found most successful for this purpose. Besides the grease from inside the pin, additional lubrication works down from the upper shoe of the crosshead. This upper lubrication is helped materially by the use of mechanical lubricators which force a metered quantity of oil at all times when the locomotive is in operation.

Heat-treatment also plays a part in the case of engine and tender truck equalizers. Heart-shaped rockers form part of the truck rigging, and are subjected to considerable wear. They are built up over-size by welding and then machined to the proper contour. Afterwards they are normalized, and the contact points of the bearing surfaces are hardened.

Over a long period of years the value of proper heat-treatment of locomotive parts has come to be realized by the railroads. Progressive lines have studied methods and installed modern equipment best adapted to their needs.

A Long Zip

CHESTER H. FRANKLIN

THE reference to the early zipper by Joseph A. Falk (*AM*—Vol. 80, page 27) stirs amusing memories of long ago. I too remember the shop in Hoboken and the "placket fastener" as it was then called. The fastener at that time consisted of small drop forged parts, one with a hook and the other with an eye. They were very nice forgings, but of course much more bulky than the present design.

I visited the plant to see an assembling machine, built by an old friend by the name of Lepper. The parts were dumped in hoppers, and as they came down the chutes they were turned so that the mating parts came together without attention. It was a most ingenious machine. According to Mr. Lepper the inventor put them on shoes and trousers during his early experiments. On one occasion the zipper refused to "un-zip," much to his embarrassment.

The device was crude to be sure. But I am inclined to blame the design rather than the lack of tool making ability to its failure to catch on at that time.

Floating Toolholders

C. G. WILLIAMS

THE other day a catalog was picked up that purported to be an authority for the information of designing and production engineers. It dwelt at length on "our system of floating toolholders."

In less than an hour another catalog was picked up that was put out by a concern that was believed to have made notable advances in certain methods of cutting metal. That catalog stated: "In all other metal cutting, we insist upon having chucks and arbors that are tight and rigid. Yet in machining it is commonly and erroneously believed that the more wabble and the more float the better the machine operates. For this reason, the majority of tools used in production last about one-tenth of their potential life. In the old days when tools could not be thoroughly heat-treated and hardened, distortion was inevitable. Floating holders were then excusable. Indeed they were necessary to correct tool inaccuracy. But today, tools have been perfected. There is no inaccuracy unless man-made in securing the tool to the holder by setscrew and monkey-wrench methods."

This is the first time in 30 years of mingling with machines, machinists and designers that the writer has seen such a statement in print. Similar statements have been turned down by editors of mechanical magazines and have been disputed by other engineers.

Some years ago, the writer worked in a gun shop where there was real production. There he learned that small drills, small straight and taper reamers and small taps, of which thousands were used, must be clamped tightly and firmly if breakage was to be reduced and accurate, true work was to be produced. This was tested and proved time and again, but was never advertised.

The writer has determined by tests that, in the use of floating holders, whenever the strain on the holder becomes sufficiently great to operate the tool, there is no slipping or sliding. The units of the holder become rigidly clamped together in the position last assumed when the strain reached the limit that would operate the tool. From that time on, the tool wabbled, bent and twisted as it revolved, until at last it sometimes broke. Even if it did not break, accuracy was impossible.

Floating toolholders should never have been allowed, but engineers firmly believed and taught others to believe that the more wabble and the more float the better a machine would operate. The few engineers who did not believe these fallacies could not make a dent in the popular conceptions of those other engineers who did, but who would not take time to demonstrate that a tap so out of true and so warped as to not admit of being clamped rigidly would make drunken threads.

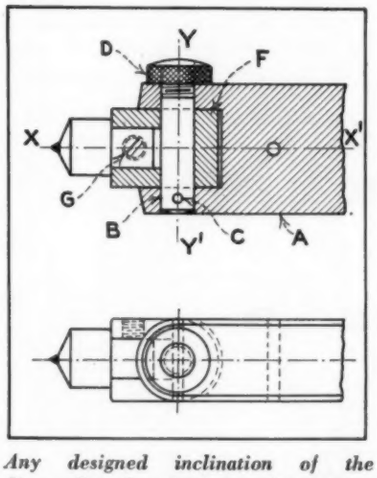
Ideas from Practical Men

Inclinable Truing Post For Wheel Dressers

PAUL GRODZINSKI
Berlin, Germany

Some diamond wheel-truing fixtures allow only such a combination of movements that the diamond is worn to a tapered form. When this occurs the effective cutting action is lost and higher pressure is required. Therefore, it is essential that the diamond holder be held in such a manner that the flat worn-off point can be given additional inclination to the wheel. Since most fixtures that allow this do not have turning axes that all pass through one point, I have designed the inclinable truing post shown. The reason for having all truing axes pass through one point is simply that no severe bending moments are introduced to require extra rigid construction.

The diamond holder is held in a common cross link as shown. Member *A* is fixed in the truing fixture of the grinder, and it has a long spring slot and a cross-wise hole for cross pin *B*. The cross pin is prevented from turning by the pin *C*. Member *F* swivels about pin *B* and is clamped by the nut *D*. A front hole in member *F* takes the diamond holder which can be turned on its axis and is clamped in the desired position by the set screw *G*. By loosening the knurled nut *D*, member *F* and the diamond holder can be turned in any required inclined position about axis *Y-Y'*. Further, if truing is no longer satisfactory in this position, the set-screw *G* can be loosened and the diamond holder turned on its own axis as required.



Any designed inclination of the diamond to the wheel, or axial rotation of the diamond, can be secured in this inclinable truing post for wheel dresser fixtures

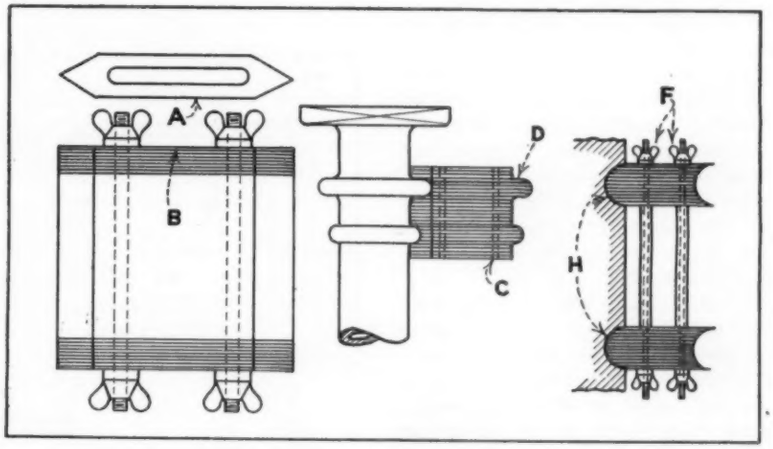
Adjustable Templets

J. T. TOWLSON
Enfield, Middlesex, England

In the illustration is shown an adjustable templet that I have found to be of considerable service in many jobs. The idea is by no means new, having been described by a contributor to the *Mechanic's Magazine* just one hundred years ago. While the contributor's device employed pointed steel rods ¼ in. in diameter, mine employs stainless steel strips, ⅝x1/32 in., slotted and pointed as at *A*. It is shown normally assembled at *B* with the strips clamped together by ¼-in. studs and wing nuts, the studs being threaded at each end nearly to the middle.

The purpose of such a templet is to transfer the contour of the part to which it is applied to another part, but in reverse, so that a part made to fit such reverse will fit the part to which it was applied. It is shown at *C* taking the contour of the beads and the fillets on a column to which it is required to make a cast-iron bracket to fit. If the pattern is made to fit the reverse part *D* of the templet, with proper allowance for shrinkage, the resultant casting will fit the beads and the fillets on the column.

The templet is shown at *F* adjusted to contours that are a considerable distance apart, as at *H*, by the use of comparatively few strips, the batches of strips being separated by light distance pieces on the studs. With a supply of studs and distance pieces and a goodly supply of strips, a templet of any reasonable size can be quickly assembled to suit the job in hand.



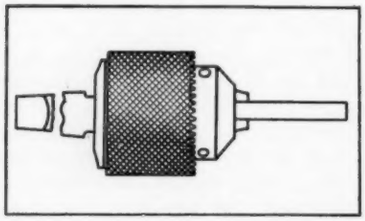
With the nuts loosened, the strips of the templet take the form of the part; after the nuts are tightened the mating piece of work is fitted to the templet

Care of Drill Chucks

HECTOR J. CHAMBERLAND

Many machinists and toolmakers seem to forget that drilling a good hole depends as much upon the condition of the drill chuck as it does upon the drill itself. As soon as a drill begins to wabble, the operator usually wallops it with a wrench or a piece of scrap until he thinks it runs true. He may not be correcting the real trouble, as many worn chucks do not hold the drills concentrically, so that the drill may be badly sprung in attempting to true it by the method described. If more attention were paid to drill chucks, their jaws would not have to be replaced so often.

Chucks of the type illustrated should be checked for truth at frequent intervals. If the jaws are out



Jaws of drill chucks of this type can easily be reconditioned to hold drills concentrically

of true they should be trued by the following method: Close the jaws lightly on a piece of drill rod about two-thirds the diameter of the chuck's capacity. Lightly solder each jaw to the body with a drop of solder and then pull out the drill rod. The insides of the jaws can then be ground in an internal grinder, after which the solder should be removed by scraping it off.

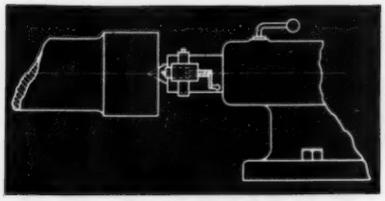
If drill chucks are given this remedy in due time, they will continue to perform at their best. However, it is good judgment to check up on the drill press spindles occasionally, since those parts of the set-up are not always up to par.

Axle Lathe Attachment

CARL H. KOTHEIMER

Circles in the ends of locomotive driving axles are essential for checking the alignment of the driving wheels. Since the center holes in axles may be damaged, the centers can always be located from the circles in the ends.

In the sketch is shown a device attached to the tailstock spindle of an



Circles can be easily and quickly cut in the ends of locomotive driving axles by this tool

axle lathe and used for cutting circles in the ends of locomotive driving axles. The circles were formerly cut by a tool held in the toolpost, necessitating a change of tools. The advantage of this attachment is that it is always in place and ready for instant use.

Indicator Holder

H. L. WHEELER

Simplicity of design and application are the features of the indicator holder illustrated. It can be held in a parallel clamp or clamped in a V-block.

For holding it in a parallel clamp, two ½-in. holes *A* are drilled and reamed at right angles to one another in one of the jaws to receive the body, so that it can be held in either of two positions. It is locked in place by a knurled-head thumbscrew. If the holder is clamped in a V-block, both it and the V-block can be clamped to any of the members mentioned above by the one clamp.

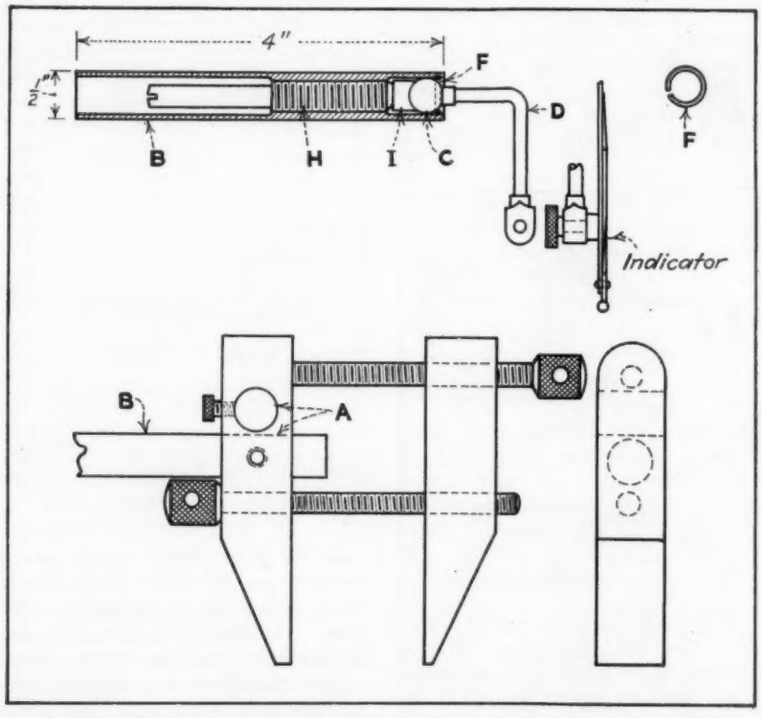
The body *B* is made from ½-in. drill rod, drilled and tapped as shown. The ball *C* of the indicator arm *D* is retained in the body by a single coil of the spring *F*, which fits neatly into a corresponding groove in the front end. The ball is adjusted for tightness by the screw *H*, which holds the fiber plug *I* in frictional contact with it.

Sliding-Key Supports For Strap Clamps

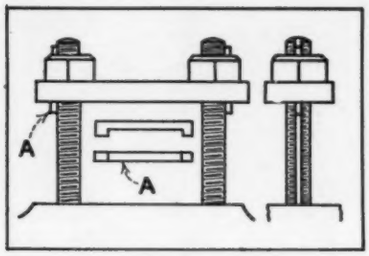
F. MUIR
Hamilton, Ontario, Canada

Instead of stiff helical springs to raise the strap clamp when the nuts are slacked off, I have found that the sliding-key arrangement illustrated works better. There is no resistance when the nuts are turned to lower the clamp, whereas with springs there is increasing resistance as the strap is lowered, until it is impossible to turn the nuts without a wrench.

Keys having double gib-heads, as at *A*, slide freely in keyways in the studs. The distance between the gib-heads is the same as the thickness of one of the nuts and that of the strap, plus enough clearance for



An indicator holder can be held in a parallel clamp by means of which it can easily be attached to a lathe tool, a boring bar or cutter arbor



Double gib-headed keys sliding in keyways in the studs span the nuts and the clamp. In screwing the nuts up or down, the clamp follows positively

easy working of the nuts. The bodies of the keys are thin enough to be below the roots of the threads in the studs so as not to interfere with the free action of the nuts. When the nuts are slacked to unclamp the work, the strap is raised by the keys.

The nuts can be easily run up or down on the studs by the fingers when the work is unclamped, and the clamp will follow just as effectively as if stiff springs were under it.

Punch for Light Metal

JOHN A. HONEGGER

A compact punch for light metals is shown in the illustration. Essentially it consists of the steel handle *A* formerly part of a Stillson wrench. to which is welded the back support *B*; the movable jaw *C*, the shank of which slides in a square hole and has rack teeth cut on it; the pinion *D* which engages the rack teeth; the adjustable stop *F*; and the operating lever *H*, a piece of hexagon steel.

Stationary portion of this little punch was formerly a part of a Stillson wrench to which has been welded a backing support for the shank of the movable jaw

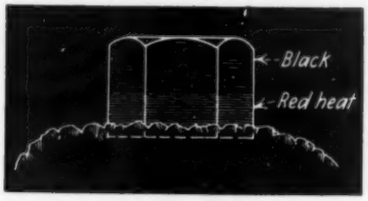
The punch *I* is held in the stationary jaw and can be removed by loosening the screw *K*. It is provided with the spring-actuated stripper *L*. The die is held in the movable jaw and can be removed by a drift entered through a hole in the jaw.

For bench use, the device can be held in the vise. For punching holes in formed objects where a greater throat height is required, the backing support *B* can be made longer as shown at *N*. The stop plate *N* prevents the shank of the movable jaw from coming out of its hole.

Oversize Nut Shrunk to Fit

F. M. A'HEARN

The machine shop foreman had an inflexible rule that a piston-rod nut must always be wrench-tight after the first few threads were engaged.



This 3-in. nut was threaded too large and was made a tight fit by alternately heating and quenching the top and the bottom

If plenty of force were required to seat the nut, so much the better. If the nut could be run the length of the thread by hand, the lathe hand who threaded it was due for plenty of trouble.

A 3-in. nut, threaded in the lathe, had been made for a rush job. Before the piston parts were ready for assembly, the lathe hand discovered that the nut was not only an easy fit, but had a noticeable shake on the thread.

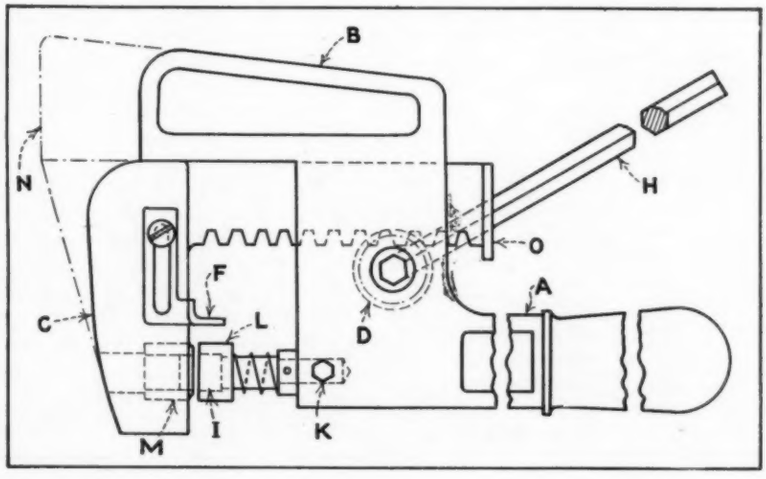
A hasty consultation was held with Bill, the blacksmith foreman, with a view to having him make a forging for another nut after the machine shop foreman had gone for the night, as the job would be continued on overtime. Bill, who was an old timer and full of trade tricks, always ready to help a luckless workman out of a jam, dispatched the lathe hand for the spoiled nut. He placed it on the fire, as shown in the illustration, and gave the bottom a quick heat while the top remained comparatively cool. Then he gradually dipped the nut, hot end down, in the quenching tank. Another heat was taken on the top of the nut and it was quenched as before. After a couple of heats had been alternately taken on each end of the nut, quenching as before, it was tried on the thread of the piston rod and found to be plenty snug.

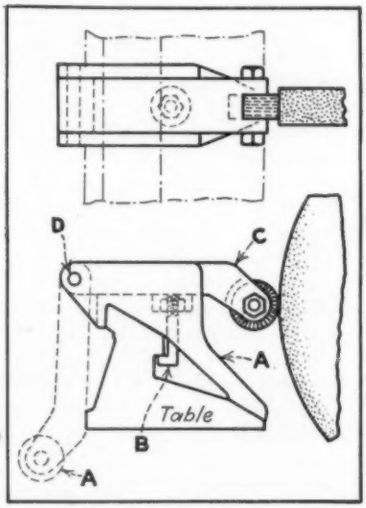
What error in thread lead resulted from the shrinking is not known. Perhaps the scale that formed on the threads helped matters. At any rate, the nut was plenty tight enough to suit the machine shop foreman, who had not been told the secret. So far as known, the nut never loosened.

Grinding Wheel Dresser

J. R. WHITTLES

A fixture carrying a dressing wheel for truing the abrasive wheel of a cylindrical grinding machine is shown. The body *A* of the fixture is attached to the table of the machine by the hook bolt *B*. The dressing wheel is





The dressing wheel can be swung back out of the way when it is not in use

carried on the arm *C*, which is hinged at *D* so that the dressing wheel can be swung back out of the way when it is not in use, as shown by the dotted lines at *F*. When the dressing wheel is in position for truing the grinding wheel, the arm *C* is confined at the sides to prevent side play.

Kinks Did It—Why?

R. B. WILLIS

Without trying to find out just why the kinked rod finally forced out the milling machine arbor that George J. Murdock tells about in an article under the above title (*AM*—Vol. 80, page 893), it may be opportune to describe another way of removing a stuck arbor.

If the arbor is of the common type having a screw thread on the outer end, a sure way to remove it is to rig up what might be called a reverse wheel puller. In almost any shop a combination of bushings and sleeves can be found that can be arranged on the arbor so that the nut for clamping the cutter can be used to get a tremendous pull on the arbor.

If the arbor has a driver that engages a slot in the spindle nose, two pieces of flat stock can be used against the spindle nose instead of a sleeve or a bushing.

After putting on plenty of pressure by tightening the nut, a blow on the knockout rod will release almost any stuck arbor.

Machining and Gaging A Concave Cut

FRANK HARTLEY

In Fig. 1 is shown a fixture that was designed for holding work of rather unusual shape, the lower part of which is convex, while the cut is concave, as shown in the upper right-hand corner.

The work, indicated by heavy dotted lines, is held against the prongs *A* and *B* in block *C* and is bedded in block *D*. Block *C* is pivoted on stud *F*, which is carried in the slide *H*. Stud *I* is attached to the slide and upon it is pivoted the lever *K* having a cam-shaped hub at *L*, which is at all times in contact with the thrust plate *M* on block *N*. Backward thrust is taken by block *O*. As the lever is turned and pushes the slide in the direction of the arrow, the work is gripped between points *A* and *P* and *B* and *S*. Pivoting block *C* about stud *F* permits the two prongs *A* and *B* to adjust themselves to any variation in the length of the work.

To prevent the work from moving sidewise during the milling cut, the hook bolt *T* is tightened over the back wall by the hand nut *V*. In operation, the knee of the machine is raised until the cutter *Z* cuts to the correct depth. The table is traversed for the length of the cut, stops in each case being properly set. At the end of the cut, the knee is lowered and the table is traversed by hand to the starting position. The work can now be removed and a new piece can be inserted.

Fig. 1—The work is gripped between prongs on a swiveling block and projections on a block mounted on a slide that is moved by a lever having a cam-shaped hub

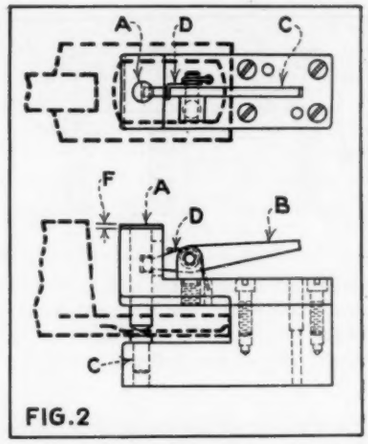
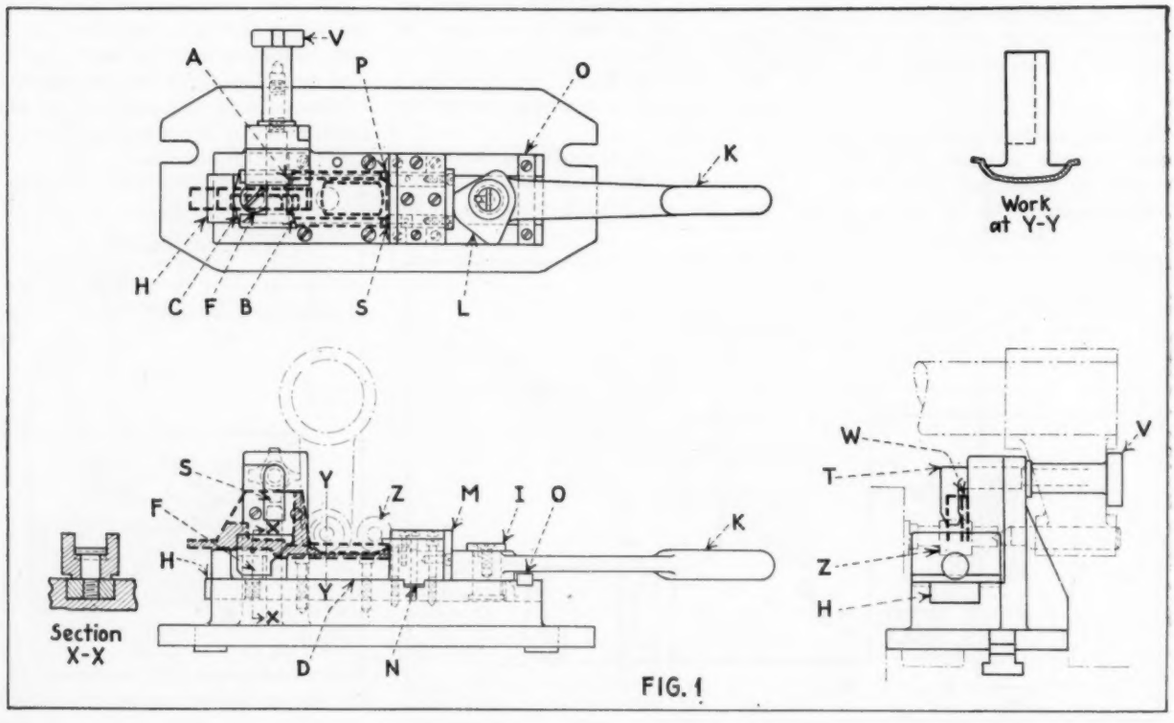


Fig. 2—Raising the flush pin by depressing the lever, the work is admitted and is placed on the head of a pin in the base and under the flush pin

Gaging the cut is taken care of by the flush-pin gage in Fig. 2. The spring-actuated flush pin *A* is raised by depressing the lever *B* and the work is set on the head of the pin *C*. When pressure on the lever is released, the flush pin is brought into contact with the work by the spring *D*, the reading being taken at *F*.



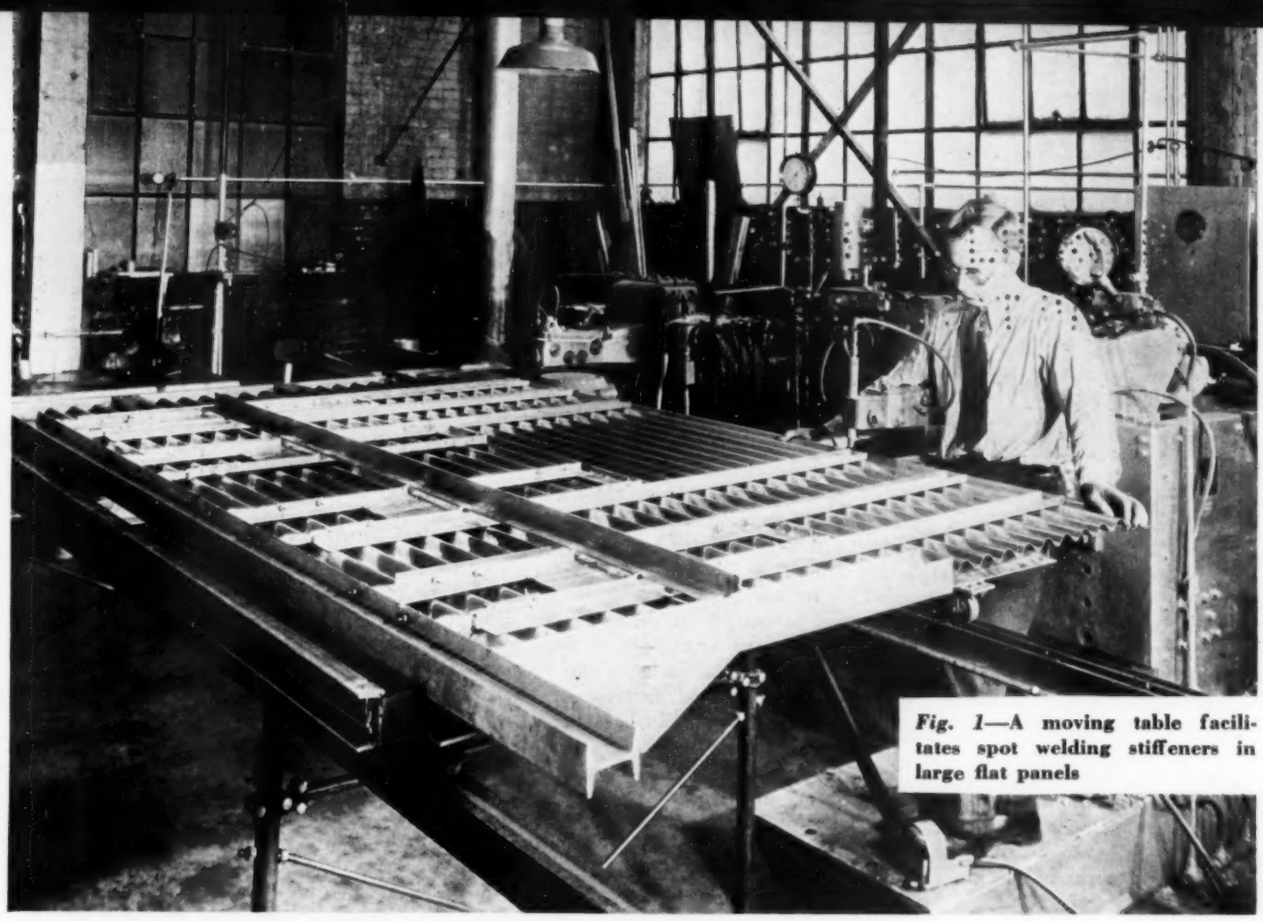


Fig. 1—A moving table facilitates spot welding stiffeners in large flat panels

Aluminum Alloys . . .

Their Spot and Seam Welding

G. O. HOGLUND
Aluminum Company of America

IT IS common practice, and in the past it has been almost universal practice, to join aluminum alloy parts by riveting or bolting. In order to attain maximum strength in the structure, full advantage is taken of the high strength obtainable by heat-treating or cold-working these materials. Other methods of joining than riveting have been attempted, particularly fusion welding with the torch or the arc, but the results have not been entirely satisfactory where maximum structural efficiency is required. The thermal effect of the welding heat on the parent material introduces distortion problems that are difficult to handle and partially obliterates the added strength obtained by heat-treating or cold-working.

Other things being equal, the time required for making welds is less, and consequently, the cost is lower for spot welded joints, than for riveted joints. In the aircraft and marine fields, the smooth outside surface that is obtained with spot welded joints can be used to lower the drag forces as compared to similar joints made with the protruding rivet heads. This factor is sufficiently important to be significant at the high operating speeds now being used. In addition, the problem of preventing leaks around loose rivets in such parts as tanks, where gas or liquid tightness is important, should be lessened by the use of spot or seam welding to make the weld, as no piercing of the surface is done.

Potential economies in resistance welding the aluminum alloys have been realized to limited extent. A typical example is the use of both spot and seam welding in assembling airplane gasoline tanks. Sufficient time has not elapsed to establish the service life of tanks such as shown in Fig. 2, but the designs have passed the thorough preliminary tests required on this type of structure. Similar construction has been used for bus tanks, as shown in Fig. 3, with capacities up to 85 gal. Several years of satisfactory service on about 3,000 tanks of various designs has shown the suitability of spot welds for this purpose. Seven hundred bridge flooring panels with spot welded channel attachment pieces and end stiffeners, have shown satisfactory service for three years. While these examples are typical of the type

Abstracted from a paper presented before the annual meeting of the Society of Automotive Engineers, January 11-15, 1937.

of work being done, they comprise only a small part of the production of resistance welded aluminum alloy designs. Other applications include airplane cowling and fittings, cooking utensils, railway car panels—in fact, the process is adaptable to the assembly of almost any parts with a section thickness less than $\frac{3}{16}$ in. which in past practice have been riveted.

Spot and seam welding equipment as designed and used for other metals is, in general, not suitable to obtain best results when welding the aluminum alloys. The reason for this is apparent when the physical characteristics of the metal are considered. Aluminum and aluminum alloys have comparatively high thermal and electrical conductivity. It follows that the amount of current to make a weld is high compared to that required for other materials and the time period allowed for the passage of the current must be comparatively short or undesirable melting and distortion will occur in the parent material near the weld.

A resistance welding system consists of a transformer to take the current from the distributional system and change it so that maximum heating effect, or amperage is available at the weld, a mechanism to apply pressure at the weld and conduct current to the weld, and a means of timing the current to insure accurate control of the heating effect of the current in successive operations.

The design of the transformer is a function of throat depth and the distance between the arms of the machine and the gage of the material which is to be welded. Experience has shown that a machine should deliver at least 24,000 amp. at the tips to weld $\frac{1}{16}$ in. thick material, 33,000 amp. to weld $\frac{1}{8}$ in. thick material, and 42,000 amp. to weld $\frac{3}{16}$ in. thick material. A means of integrating the maximum current to permit welding intermediate thicknesses is also required. An auto-transformer that will control the primary voltage from 20 per cent full voltage to 100 per cent voltage in 25 to 30 steps, will provide adequate control of the current. In this connection it should be noted that the convention kva. or kw. rating on a machine nameplate is generally not a reliable means of determining the machine capacity. The capacity in amperes at the tips can be determined for various arm positions by simple electrical tests and a calibration of the equipment is a first essential when starting on an aluminum job.

In connection with the pressure mechanism, it is desirable that the upper head be as light as possible to reduce the inertia loads and to minimize mechanical damage or distortion, particularly in light gage parts. Pneumatic or hydraulic actuation of the pressure can be regulated accurately and quickly. These methods also provide constant pressure regardless of the distance between the tips prior to making the weld. For many jobs it is desirable that the mechanism be arranged to permit application of the pressure to clamp the parts prior to the application of current.

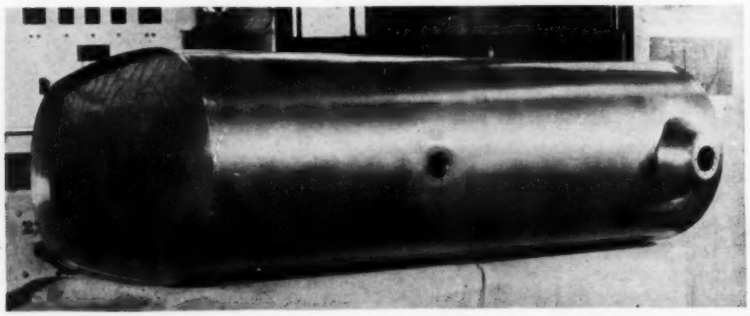


***Fig. 2*—Airplane gasoline tanks assembled by both spot and seam welding have proved satisfactory under test**

It is important that proper timing equipment be used to obtain consistent results in either spot or seam welding the aluminum alloys. This equipment must be such as to insure duplicate shots of power to the work; manually operated switches, in which the operator can vary the time of the impression of current, are not satisfactory. Best spot welding results are obtained with full electronic equipment that will time the current synchronously. For welding gages between 0.015 to 0.188 in. thick, periods varying from 2 to 25 cycles of the standard 60-cycle current wave are required. Good results can also be obtained on many types of work with the non-synchronous contactor type timers actuated either mechanically or by vacuum tubes.

When seam welding it is essential that full electronic equipment be used. The technique required involves delivery of the current to the work at a duty cycle of less than 30 per cent. Timing cycles of one cycle on and three off, one and a half on, four off, or two on and six off, are typical of the settings used for seam welding from 0.032 to 0.064 in. material. No adequate means other than electronic timing are available for this service.

Pneumatic Operation

The design of the machine, throat depth, etc., are dependent on the class of work to be done. For general purposes, however, a spot welder, used with good results, is air operated and arranged so that the arms can be set in any position with the tips closed on the work or open to suit the job. Machines of this type, or designed on the same principles to suit particular jobs, can be obtained commercially from almost all of the welding machine manufacturers.

Experience has determined certain factors which are of importance in the control of shop operations if full advantage is to be taken of the capabilities of resistance welding equipment. These factors include preparation of the work, maintenance of electrodes and checks on machine set-up.

Preparation of the work to insure consistent strength of the welds and rapid welding involves proper fitting of the parts and cleaning the surface. It is essential that contact between adjacent parts be obtained in assembly of the parts to be welded. The resistance in the joint, and consequently the strength of the weld, is dependent on the pressure. If a large portion of the pressure between the tips is used to draw the parts together, it follows that the strength of the welds will not be consistent. In addition, improper fitting of the parts will cause distortion in the structure and in some cases preloading of the welds.

All aluminum is covered with an oxide coating that forms in the atmosphere and varies in thickness depending on the fabricating procedure used in making the particular alloy. The electrical resistance of the coating is comparatively high, and the size of the weld is a function of thickness of the coating at the interface between the parts. Also, the pres-

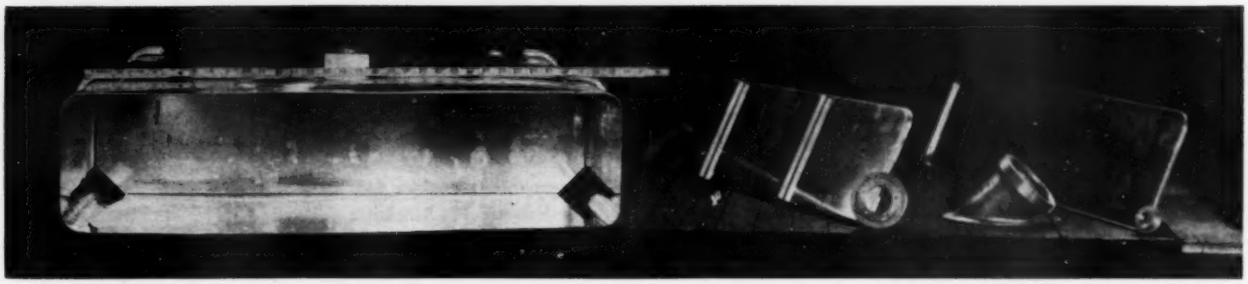


Fig. 3—**Some 3,000 welded aluminum bus tanks have shown their merit during years of actual service**

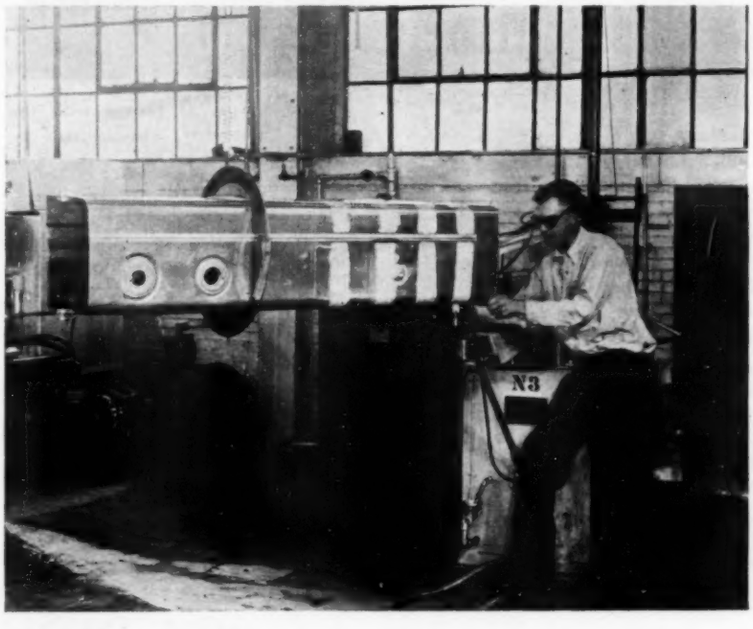
ence of a heavy coating on the outside of the parts contacting the tips causes excessive surface heating and alloying of the aluminum with the tip material, and consequently low tip life. Except on commercially pure aluminum (2S) and on the alloy 3S, where the coating is not sufficiently thick to be harmful, it is desirable to remove the coating prior to welding on all of the aluminum alloys on the surface of the metal contacting the tips. In some cases, particularly the heat-treated alloys, where the coating is unusually heavy, it is also removed from the contact area between the parts.

Removal of the coating can be accomplished mechanically with an abrasive cloth or by wire brushing with a fine wire wheel. On large parts, removal of the coating can be done more economically with a chemical etch. An etching solution that has been found useful for this purpose is prepared by first dissolving 2.9 lb. of gum tragacanth in 80 lb. of boiling water. Solution of the gum tragacanth can be accelerated by adding 7.1 lb. of denatured alcohol, though this is not necessary with all grades of gum. The preparation of the etching solution is completed by adding 10 lb. of 30 per cent hydrofluoric acid.

Cleaning is done by painting the area to be welded with the etching solution and washing the surface with water after a period of from 15 to 30 sec., depending on the condition of the surface. While the cleaning is usually done just prior to welding, the surface can easily be preserved for several days by painting the cleaned areas with a light oil. The use of an etch for cleaning is illustrated in Fig. 4 showing the spot welding of baffles in an airplane gasoline tank.

Proper design and maintenance of electrodes are essential to obtain consistent spot welds on aluminum. Variation of the contact area of the electrode tip will change the current and pressure distribution, and contribute to inconsistent strength of the welds. The common method of dressing electrodes with a file is entirely unsuitable for spot welding aluminum. A simple means of maintaining tip contour is shown in Fig. 5. A 165-deg. included angle cone is machined on the tip, and in use no cleaning is done on the tip surface with anything but a fine grade of abrasive cloth. A tip of this type will make between 250 and 400 spot welds before remachining is necessary. Equally good results have been obtained with spherical ends on the tips but the above procedure was adopted because of the ease of machining the tip contour.

Fig. 4—**A cleansing etch insures clean welds for the baffles in an airplane tank; note the fixture for ease in handling**



Copper Alloy Tips Best

Copper alloys with high electrical conductivity and mechanical strength have proven most satisfactory as tip materials. Various materials have been investigated for this purpose, and no alloy of copper with a conductivity less than 75 per cent of pure copper, has been found suitable. Hard drawn copper rod will make good spots without excessive alloying or "pickup" with the aluminum surface but will anneal and mushroom in production. There are a number of heat-treated copper alloy materials available that are suitable for this service. Water cooling to within $\frac{3}{8}$ in. of the contact surface of the tips is necessary to insure good tip life.

Production speed in making spot welded structures varies from five spots per min. for large unwieldy parts such as gas tank assemblies to 150 spots per min. for small parts that can be handled easily by one man. The making of a single spot takes only a fraction of a second, and the major portion of the time is required to index the part to the next spot. The great variation in the type of work done makes it difficult

to be more specific in this connection. In seam welding, speeds of one to six ft. per min. are attained for gas or liquid tight welds, and from six to fifteen ft. per min. if the spots are placed intermittently. In this case also, due allowance must be made for handling the part. As the indexing between the welds is automatic, the idle time is substantially less than with spot welding.

The use of jigs and fixtures to hold and align the parts is an important feature in lowering the over-all cost. Such jigs should be light and flexible to permit rapid movement of the parts. A simple fixture for supporting a tank is shown in Fig. 4 which permits the welding to be carried out by a single man. A similar fixture operated by two men has been used in welding tanks up to 250 gal. in capacity and weighing 100 lb. A movable table of the type shown in Fig. 1 has been found useful for spot welding stiffeners to large flat panels.

No non-destructive tests have been developed that will show the strength or quality of a resistance weld in the completed part, and inspection is limited to a visual examination of the surface for cracked or "burned" welds. Control of the quality of the welds is, of necessity, ascertained by making periodic test samples of the same gage and alloy as the object being welded, and testing those samples by tearing or in a tensile testing machine. Further assurance that the correct machine set-up is being maintained is obtained by providing instruments to check each welding cycle.

Correct adjustment of the current from day to day or week to week is done by installing a current transformer on the primary circuit of the welder and reading the current on a conventional ammeter. The welding cycle is too short to permit the needle to come to rest, but the deflection for any one setting of welding current is constant and proportional to the heating effect at that setting. A record of the deflection is made and settings can be duplicated later for further work. A check on the machine settings from weld to weld is made in a similar manner except a variable resistance is provided in the ammeter circuit to permit setting the instrument to give a fixed deflection. At this deflection the hand is made to intercept a light beam which by means of a photo-electric cell actuates a bell. A change in machine set-up while welding, to increase either the time or the current, will increase the deflection and the bell rings twice. A change to decrease the time or the current decreases the deflection and the bell does not ring. In either case, however, even though the operator's eyes and hands are busy following the work, he can stop welding and correct the faulty condition immediately after it occurs.

In spot welding aluminum a spheroidal cast "bubble" shaped volume is formed at the interface between the parts by the passage of the current. The best combination of strength, toughness, and resistance to corrosion is obtained if the weld extends about two-thirds of the distance to the surface of the piece. The strength in shear of a weld of this type is generally comparable to the strength of a rivet in the same gage and alloy.

As far as is known, there are no aluminum alloys which cannot be spot welded, and the strength of the welds depends on the alloy being welded. The amount of cold work in the parts also influences the strength with the soft or annealed temper showing the least strength, and the cold-worked or heat-treated temper the highest strength. The breaking load for spots in some typical alloys is shown in the accompanying table. As the size of the spot is a function of the thickness of the material, it follows that the strength depends on the thickness. Fig. 6 shows the variation in shear strength for various gages of two of the commonly used alloys for spot welding purposes. All combinations of gage and alloy have not yet been tested,

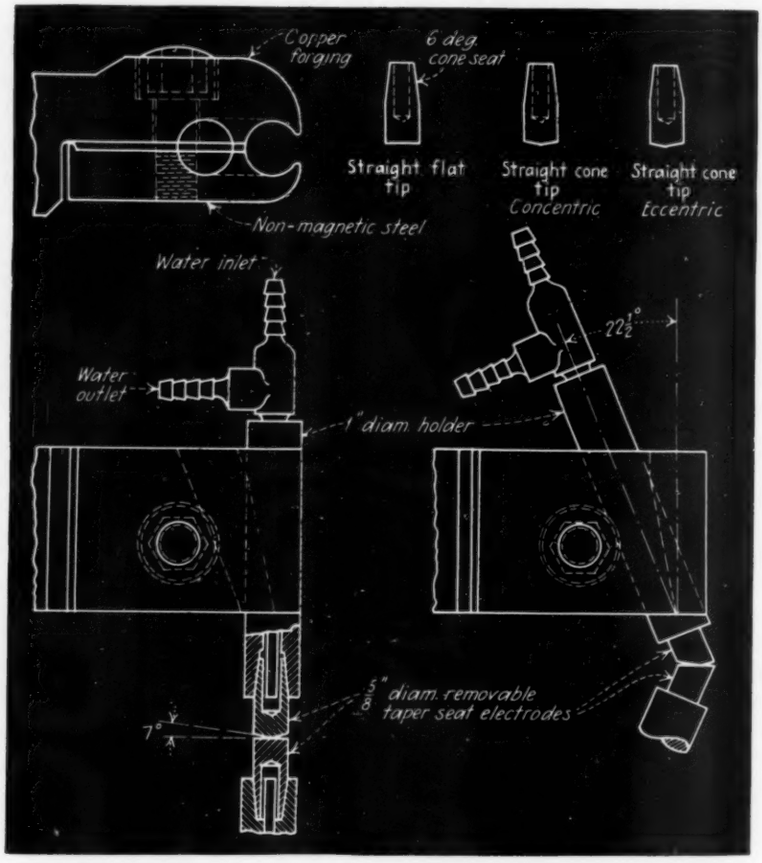


***Fig. 5*—Tips, as shown with the holder assembly, should not be filed but dressed with fine abrasive cloth**

Breaking Loads on Spot Welds in Various Aluminum Alloys

Alloy	*Breaking Load Pounds*
2S½H	200
52SO	240
52S½H	450
Alclad 17ST	350
Alclad 24ST	360
53ST	350

Note: **These figures represent the average shear strength per spot obtained on five or more 1-in. wide two-spot test specimens. All specimens were made from sheet 0.032-in. thick.**

though the scope of the data is rapidly being extended where specific cases of immediate interest occur. Each point on these curves and the two groups following, represents the average breaking load per spot determined by testing five duplicate 1-in. wide two-spot test specimens. The specimens were tested by loading the spots in shear.

Another factor that is of importance in using spot welds, concerns the effect of the distance between the center of the spot and the edge of the joint. Placing the spots too near the edge of the sheet permits squeezing out of some of the molten metal because of lack of mechanical support around the weld. When this occurs there is a loss in strength. The effect of this variable in 52S½H sheet is shown in Fig. 7. As shown on these curves, the welds should be placed at least four times the thickness of the sheet from the edge.

The distance between the spots is also important. Spacing the welds too close together provides a shunt for part of the welding current through the adjacent spot. The magnitude of this effect varies with the gage of the material and is shown quantitatively for 52S½H sheet in Fig. 8. In this case it does not follow that spot welds should not be spaced closer than the minimum spacing shown on the curve where full strength is obtained. If a closer spacing is desired, full strength can be obtained by increasing the current to compensate for the shunting effect, or, and this is usually the case, individual tests can be made to determine the strength of the spacing chosen.

Some work has also been done in determining the serviceability of spot welds in resistance to fatigue or vibrational loading. No absolute values of fatigue strength have been determined as the tests were designed to permit the comparison of spot welds with rivets in both tension and shear. Results of this work indicate that spot welds will resist such loading as well as rivets. Further evidence that spot welds can be used in vibrating structures has been obtained from the standard 25-hour vibration tests specified for airplane gasoline tank designs and a number of designs have satisfactorily completed the test.

The resistance of spot welds in the commonly used alloys, when exposed to various corrosive conditions, is being tested. In view of the good resistance to corrosion of the base materials in which the welds are made, such tests generally take a substantial time before comparative data are available on the welds.

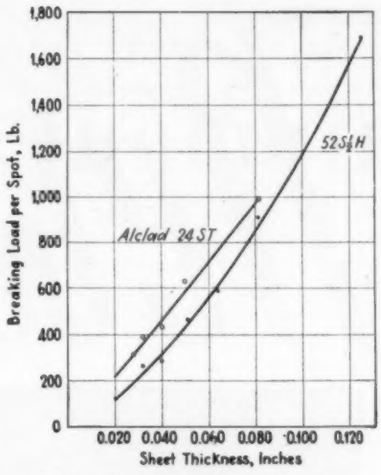


Fig. 6 **— Strength of spot welds in two common alloys is shown in relation to the sheet thickness**

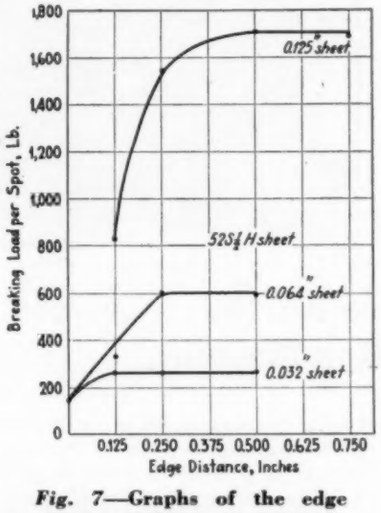


Fig. 7 **—Graphs of the edge distance indicate that this dimension should be at least four times the sheet thickness**

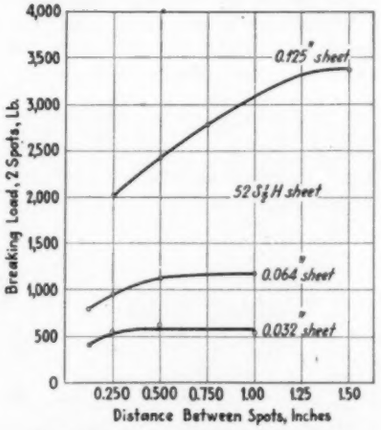


Fig. 8 **—Spot welds placed too close together have a shunting effect on the welding current unless the current is increased to compensate**

In many cases spot welds are exposed to nothing more severe than the atmosphere and this exposure was chosen for one set of tests. In order to provide severe conditions, the specimens were exposed on the coast line at Point Judith, R. I., in such close proximity to the water's edge as to deposit salt spray on the specimens during stormy weather. After one year's exposure tests on the specimens showed no loss of shear strength on the welds made in 2S½H, 52S½H, 53ST, Alclad 17ST, and Alclad 24SRT. Slight losses were obtained on testing the welds in 17ST and 24ST. Examination of additional specimens after two years' exposure showed no evidence to indicate that different results would be obtained if tensile tests were made at the time, and it was decided to expose the specimens another year before testing the next group. This will be done in June, 1937. The results in this test confirm earlier salt spray tests.

Additional data have been obtained by exposing spot welded panels to alternate immersion in Hudson River water at Edgewater, N. J. In this case, the panels are so exposed that at hourly intervals the lower portion is continually immersed in the water, the middle position is alternately immersed, and the top is exposed only to the atmosphere above the water line. The corrosive medium is brackish tide water from the Hudson River which also contains appreciable quantities of industrial waste.

Under such severe conditions of exposure, the bare materials without paint protection are, of course, subject to some attack. Visual examination of the spot welds, however, shows no preferential attack in the welds as compared to the parent sheet for welds in 2S, 3S, 52S, 53S, Alclad 17ST, Alclad 17SRT, Alclad 24ST and Alclad 24SRT. As separate panels were tested to cover the range of commercial tempers and heat-treated forms of the above alloys, the conclusion is jusified that there is no apparent difference in the resistance to corrosion of spot welds in the various tempers of the above alloys. The welds in the alloys 51S, 17S, and 24S, show some attack in the completely immersed and alternately immersed portion of the panel. This result confirms the result obtained with other corrosion tests that the resistance to corrosion of the welds is not as good as the parent material in these alloys, and that another alloy should be chosen or the welds protected with paint coatings.

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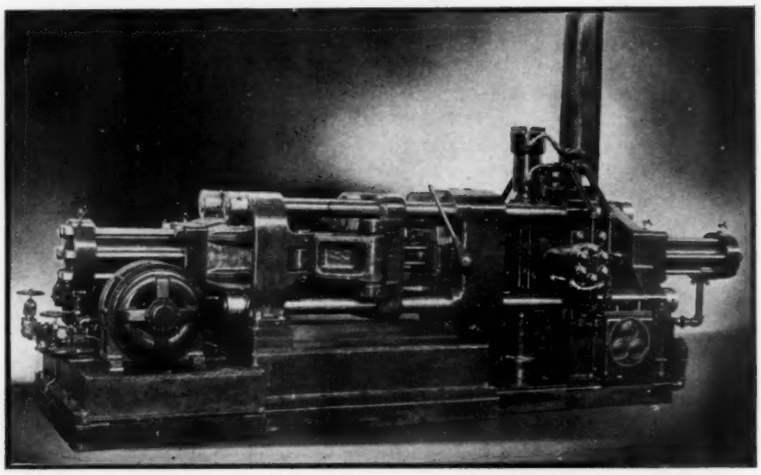


Semi-automatic Reed-Prentice brass die casting machines are now available in four capacities, of which the No. 8G machine is the largest

Reed-Prentice No. 8G Brass Die-Casting Machine

The No. 8G brass-alloy, die-casting machine, announced by Reed-Prentice Corp., Worcester, Mass., is semi-automatic in operation. In use, the operator closes the dies and cores by means of a lever and then ladles the material into the metal cylinder. He then steps on a pedal, which operates the plunger and forces the metal into the dies. When the metal has solidified and the cores have been withdrawn, the machine automatically opens and forces the slug out of the die.

This machine is equipped with an Oilgear pump which is furnished with special control to reduce delivery when the line pressure reaches 1,000 lb. per sq. in. pressure. The pump maintains this reduced delivery until the line pressure reaches 2,000 lb. per sq. in. at which time the stroke reduces to a point that will maintain this pressure without an oil pot. A nitrogen bottle having capacity for nitrogen under 1,000 lb. per sq. in. is furnished, permitting the storage of oil in the bottle in order to secure fast speed to the plunger. Nitrogen under pressure is loaded in the bottle and, during the idle cycle of the machine, oil is pumped at 2,000 lb. per sq. in. pressure against the nitrogen pressure, making a supply of oil under pressure available at the start of the next working cycle.

Die plates are 34x36 in. and space between bars is 20 x 22 in. The die opens 12 in., and the maximum die space is 17 in. Minimum die space, with core cylinders is 7½ in., without core cylinders, 5 in. The movable die has an adjustment of 12 in. A 30 hp. 900 r.p.m. motor drives the oil pump. The machine is 19 ft. long.

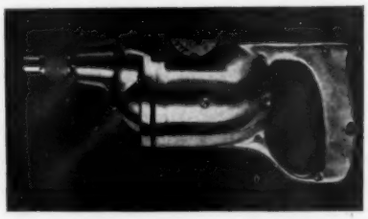
"Shield-Arc 100" Welding Electrode

"Shield-Arc 100" electrode, announced by The Lincoln Electric Co., Cleveland, Ohio, is a heavily coated electrode of the shielded arc type. It is designed for welding steels having somewhat higher ultimate strengths than those ordinarily welded with "Shield-Arc 85" electrodes. Welds produced by the new electrode in the higher tensile steels possess ultimate strength of 100,000 to 105,000 lb. per sq.in. as welded. In the as-welded condition, ductility of welds is from 12 to 18 per cent elongation in 2 in.

This electrode is suitable for flat, vertical and overhead welding and is available in ⅛, $\frac{5}{32}$ and $\frac{3}{16}$ in. sizes.

Clark Light Duty ¼-In. Drill

The ¼-in. "Jasco Junior" drill is manufactured by the James Clark Jr. Electric Company, Louisville, Ky. This tool is of the light-duty type and weighs but 3¾ lb. It has an over-all length of 10½ in. and is designed for work of an intermittent nature. It is furnished complete with a 3-jaw key-type chuck.



G.E. Type "HGA" Auxiliary Relay

The General Electric Co., Schenectady, N. Y., announces the Type "HGA" auxiliary relay which can both open and close a circuit and operates on either a.c. or d.c. circuits. The relay is made in a double-pole arrangement, with either two or four contacts. Contacts will make and carry 30 amp. for one minute or 12 amp. continuously. All parts of the magnetic circuit are of silicon steel and are cadmium plated. The relay is back-connected, with contact studs of sufficient length to mount on panels up to 2 in. thick.

DuPont "Neoprene"

E. I. duPont de Nemours & Co., Inc., Wilmington, Del., announces that the word "Neoprene" has been adopted as a generic term for the chloroprene polymers formerly sold under the trade name DuPrene. This action has been taken in order to provide manufacturers with a name which can be applied both to the unvulcanized material and to the products made from it, corresponding to the accepted usage of the word "rubber." The name "Neoprene" will not be trade-marked and may be freely used by rubber manufacturers to describe products which display the distinctive characteristics of this unique material. Products made from this material resist the deteriorating effect of oils, gasoline, solvents and refrigerants to a marked degree. They are also of value where heat, sunlight and ozone are encountered.

Sullivan Air Line Anti-Freeze System

The Sullivan Machinery Co., Michigan City, Indiana, has announced improvements in the Tanner Tank air-line anti-freeze system. The new Tanner tanks are built to A.S.M.E. specifications of welded construction for 200 lb. working pressure and are easily installed. It is claimed that this system eliminates air line and

air tool freezing and that it is harmless, odorless, and non-explosive. It will not injure metal, hose or lubrication. The system is guaranteed to give protection to 70 F. below zero.

Stanley Electric Disk Sander

Electric disk sander No. 77, offered by the Stanley Electric Tool Division, The Stanley Works, New Britain, Conn., is designed for production and repair work. It is ball-bearing equipped throughout, light in weight and easy to handle. The sander is furnished with a 7 in. flexible pad, twelve sanding disks, wrenches and a heavy rubber-covered 3-conductor cable.

"Murex" Type N Coated Electrode

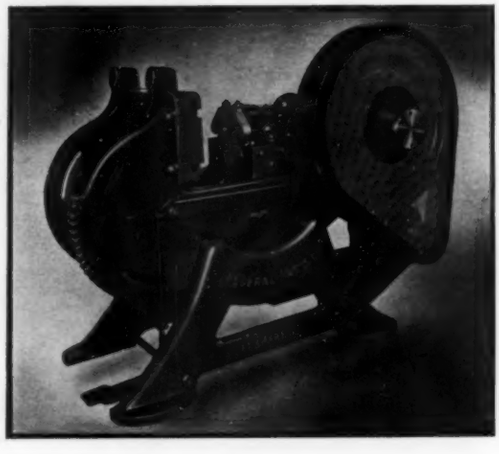
Metal & Thermit Corp., 120 Broadway, New York, N. Y., is offering the "Murex" Type N coated, arc-welding electrode for bridging gaps where fit-up between plates is poor. In smaller sizes it is used for vertical and overhead welding, or for rapid, single-pass welds on light gage materials.

Physical properties of the deposited metal range from 74,000 to 84,000 lb. per sq.in. tensile strength with 26 to 24 per cent ductility. This electrode works equally well with a.c. or d.c. and may be used either with straight or reversed polarity.

Federal Open-Back Inclinable Press

The Federal Press Co., Elkhart, Ind., is now manufacturing a line of horizontal open-back inclinable presses which are constructed along the same line as the regular Federal inclinable presses. Special features include long ram guides with wide, flat bottom and angular top bearings, fitted to gibs with adjustment from either side. This makes it possible to maintain perfect alignment at all times.

These presses are especially adaptable for automatic feeds, such as roll or pinch feeds, and are equipped with the improved built-in, non-repeat, sliding-key clutch mechanism. Flywheel is Timken roller bearing equipped, which eliminates many of the former clutch troubles. Bolster plate, upper knockout bar in the ram and the knockout bracket are standard.



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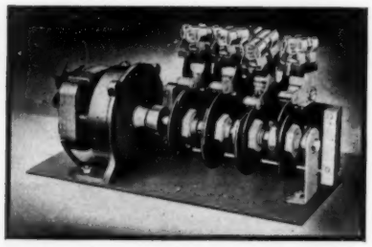
E-S Time-Cycle Controllers

Two general types of time cycle controllers, using Staley metallic mercury switches, have been designed by the Electric Switch Corporation, Columbus, Ind. These controllers



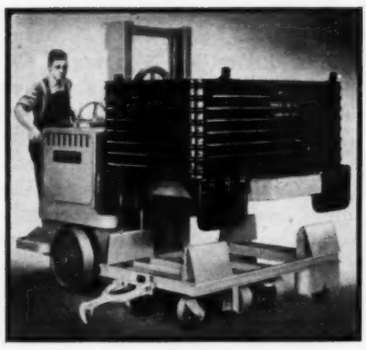
are particularly adapted to sequence control of electrically operated machines. Staley metallic mercury switches consist of a mercury-to-mercury make and break contact housed in a metallic envelope. They are hydrogen filled and are equipped with a seal which prevents gas leakage. A refractory material breaker is used to localize the point of circuit make and break and means are provided to insure quick operation by dionizing the arc at the circuit interruption. These switches are supplied in 5, 10 and 15 amp. capacity.

The Model 611 controller operates one or two circuits at the rate of 15, 30, 45 or 60 circuit makes and breaks per min., the timing sequence and time of circuit operation being accurately adjustable by means of the cams. Model 602 is available with speeds ranging from 1/11 to 60 makes and breaks per min.

Mercury Skid Trailer

The Mercury Mfg. Co., 4118 S. Halsted St., Chicago, Ill., is now offering Model A-310-119M skid carrying trailer, designed to link together the lift-truck skid and the tractor-trailer systems of material handling. The corrugated box skid with cut-away supports can be picked up at either end or side by the truck and deposited onto the steel plate bolsters of the trailer, from either side or from the rear end.

Trailer is of the caster-steer type

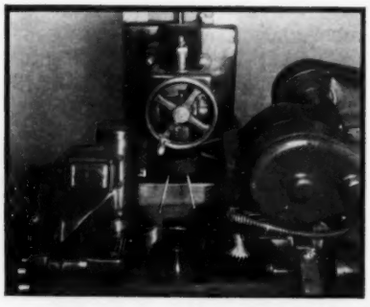


and has a steel channel frame. Clearance of the trailer is 11 in. to permit operation with standard 11 in. platform truck trailing axle.

The trailer is equipped with Mercury standard hook hitch and towing eye, and has a capacity of 2 to 3 tons. Standard unit has an overall width of 28 in., overall length of 66 in., (excluding coupler) and an overall height of 22 in.

Michigan Two-Cutter Gear Finishing Machine

This two-cutter, crossed-axis, rotary gear finishing machine has been designed by the Michigan Tool Co., 7171 E. McNochols Road, Detroit, Mich., to meet gear finishing requirements of plants where production requirements do not justify the use of the rack-type gear finisher. In this duplex machine the gears are mounted between centers and are



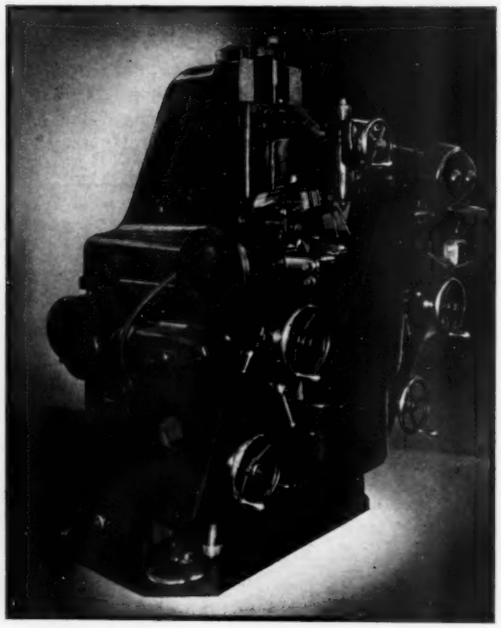
passed between two crossed-axis cutters toward the rear of the machine during the working stroke. The two cutters can be used independently to finish simultaneously two gears of different characteristics in a cluster or both right- and left-hand sides of a herringbone gear, thus eliminating duplicate machines and reducing cutting and loading time. This is made possible by making the two cutters separately adjustable as to height, position with reference to axis of gear, and amount of crossed-axis setting.

The crossed-axis setting results, as in the rack type machine, in creating a sliding action lengthwise of the teeth as the cutter and work are rotated in mesh. Graduations are provided on the cutter-carrying heads for adjustment of the crossed axis, or measuring pins may be furnished for this setting. Feed of the work back and forth through the cutters is by individual motor drive through reduction gears.

Adjustment for correct location of cutter axis is by hand-wheels at the right and left of the work, while adjustment for height is by hand-wheels below the other two. Crossed-axis setting is made in each head.

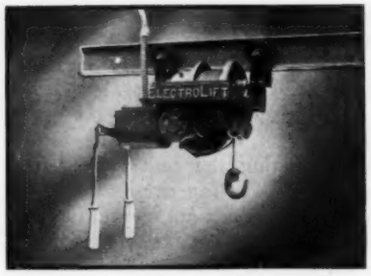
The cutting lubricant pump and tank are located in the base of the machine and are protected from dirt.

Cutters in the Michigan Duplex Gear Finisher can be set to finish two different gears of a cluster simultaneously



Electro Lift Hoist

The high-speed, close-headroom, "Junior" type hoist, manufactured by Electro Lift, Inc., 30 Church St., New York, N. Y., has a hoisting speed of 60 ft. per min. and is built in sizes of 250 lb. and 500 lb. It is useful for handling small loads in volume production, saving much time over hand labor.

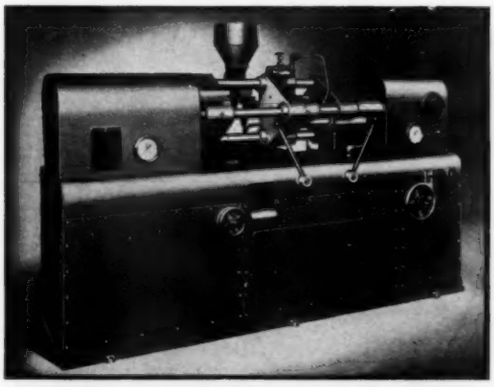


This hoist has worm-gear drive with worm and wheel running on Timken roller bearings. The motor is directly attached to the hoist frame, giving a compact arrangement. Either rope- or push-button control is available.

H-P-M Extrusion Plastic Molding Press

The H-P-M hydro-power plastic extrusion molding press has been developed to perform extrusion molding operations with speed and economy. This improved model is offered by the Hydraulic Press Manufacturing Co., Mt. Gilead, Ohio, as a self-contained machine which works hydraulically, with all functions synchronized for accurate operation.

Granular material is fed from a hopper which is directly connected with the heating chamber. A reciprocating plunger forces the material through the heating chamber where it is brought to the required plasticity. The plastic is then subjected to a high pressure for extrusion into the mold. The two halves of the mold are carried on platens, one of which is movable for closing and opening the mold. The inner platen has a floating action for bringing the mold inlet in contact with the extrusion nozzle. Both halves of the mold are chambered for circulation of cold water to chill the plastic after the cavities are filled. Molded parts are ejected automatically

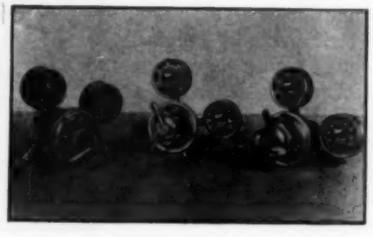


Both the clamping and extrusion pressures are independently regulated by means of hand wheels at the front of the machine. These regulate the output of the two hydraulic generators which provide the operating pressures. Control of all machine movements may be either manual or automatic. Finishing of plastic molded parts is confined to merely removing the gate and sprues, which is usually a simple clipping operation.

Oxweld Regulators

A series of three regulators, providing accurate oxygen and acetylene regulation through the entire range of welding and cutting operations, has been announced by the Linde Air Products Co., 30 E. 42nd St., New York, N. Y.

Oxweld Type R-64 oxygen regulator is designed for use in all welding and cutting operations requiring oxygen pressures up to 75 lb. per sq. in. Type R-65 oxygen regulator is designed for heavy-duty cutting operations which may require oxygen pressures as high as 200 lb. per sq. in.



This instrument may also be used for welding should the need arise, as sensitivity of adjustment and precision of operation are obtained throughout its pressure range. The Type R-66 acetylene regulator is a companion piece for either of the oxygen regulators.

Chambersburg Pneumatic Hammer

Operated from normal shop supply of compressed air at pressures of 75 to 100 lb. per sq.in., this pneumatic hammer offered by the Chambersburg Engineering Co., Chambersburg, Pa., has a lightweight ram which may be adjusted or modified to accommodate any particular shape. The machine may be operated by hand lever or by means of a special treadle. This treadle can be so placed that the operator will have maximum visibility of the work and complete control over the movement of the ram. While designed primarily for forming parts in the airplane industry, this machine will have use wherever large quantities of sheet metal are to be formed.

Thomson-Gibb Bench Spot Welder

The bench-type spot welder developed by the Thomson-Gibb Electric Welding Co., 164 Pleasant St., Lynn, Mass., has all the precision features of a standard floor-type welding press. The machine is powered with a 10 kva. transformer and is driven with a ½-hp. motor through a reduction unit. A cam at

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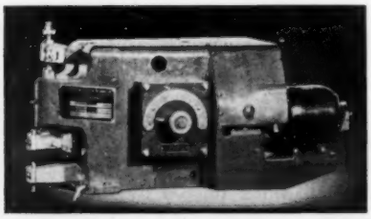


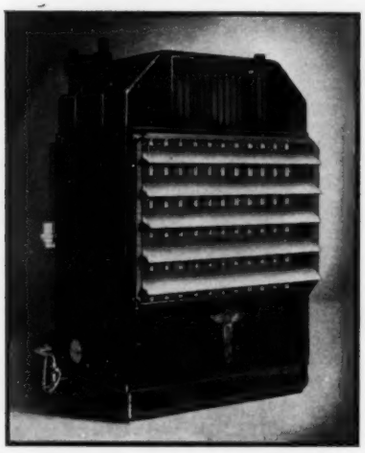
Bench-type Thompson-Gibb foot-operated spot welder

the back actuates a rocker arm which moves the welding spindle up and down with a straight-line motion. Operation is controlled by a foot switch which acts through a solenoid clutch.

The model shown has watercooled terminals only, where necessary the electrodes can also be water cooled.

Capacity of this unit is two pieces of $\frac{1}{8}$ in. clean iron or steel. It has a pressure range of 25 to 100 lb., and a throat depth of 4¾ in. Net weight is 450 lb. Over-all dimensions are 15¾ in. wide., by 32 in. long, by 17¾ in. high.

Surface Combustion Unit Heaters



"Janitrol" unit heaters, manufactured by the Surface Combustion Corporation, Toledo, Ohio, are simple and positive in action and clean heating service is rendered automatically. No labor is involved in using these units, it being necessary only to light the pilot burner at the beginning of the heating season and to set the thermostat at the desired temperature.

When the temperature in the room in which the unit is located drops below the point at which the thermostat is set, the thermostat contacts close, starting the unit heater fan. Starting of the fan causes the main gas valve to open and permits gas to flow to the burners. If the pilot light is not burning it is impossible for the main gas valve to open.

Carboloy Tool Kit

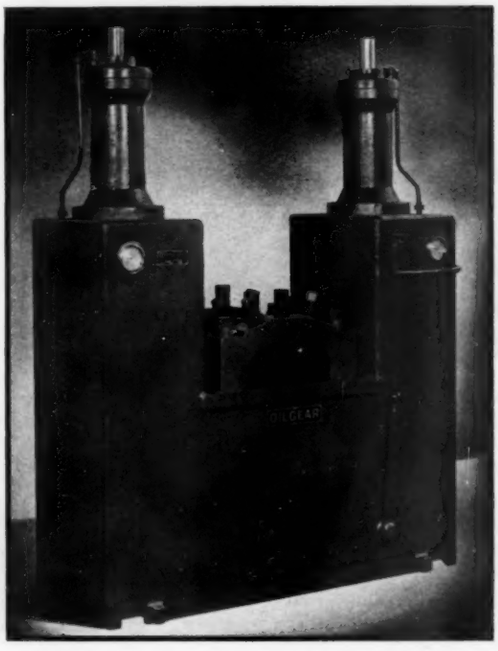
A tool kit offered by Carboloy Co., Inc., 2985 E. Jefferson Ave., Detroit, Mich., contains nine Carboloy "milled and brazed" tools, a 20-page booklet describing the rapid grinding technique and a 12-page booklet showing more than 50 suggested applications for the nine tools. This kit is particularly adapted for small shops whose limited production does not warrant purchase of single-purpose carbide tools. The nine tools in the kit are designed for general turning, facing and boring operations on engine lathes, turret lathes, boring mills and for use in boring bars. All operations on these tools have been performed except grinding. This is done by the user.

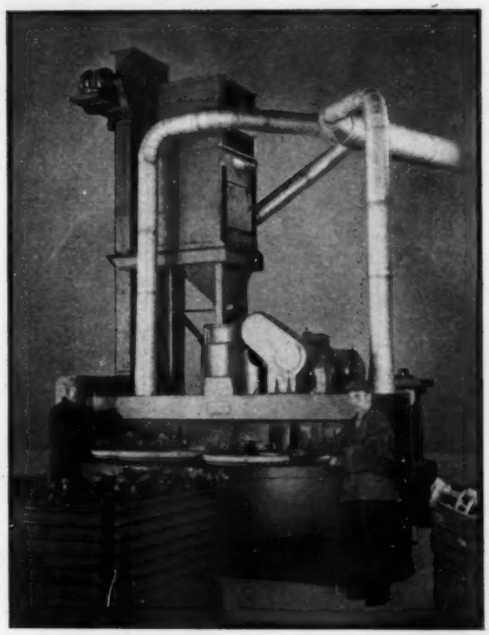
Oilgear Special Propeller Twisting Machine

Airplane propeller blades ranging in size from 5 in. wide by 1 in. thick to 14 in. wide by 4 in. thick are twisted into shape by this hydraulic machine designed and manufactured by the Oilgear Co., 1319 W. Bruce St., Milwaukee, Wis. It was built to supersede manually operated devices using a clamp and long bar with man power, or similar devices with hydraulic jacks.

Hydraulic power, with a manual follow-up control to a floating arm, smoothly and accurately twists the propeller blade to the pitch required at the various sections. Three large screws in each of the stationary clamps and the twister arm are adjusted to suit the contour of the propeller and hold it firmly in place for the twisting operation. The all-steel, welded frame incloses the pump, electric motor, piping, control and operating mechanism.

In the center of the machine frame is a floating twister arm supported in the normal starting position by two cage springs, one on each end. This twister arm is equipped with three large screws for clamping the propeller in place and a self-adjusting support block which adjusts itself to the lower propeller contour. Two vertical, non-differential, hydraulically operated cylinders apply an equal force to each end of the arm.





Pangborn Type "LG" Rotoblast Table

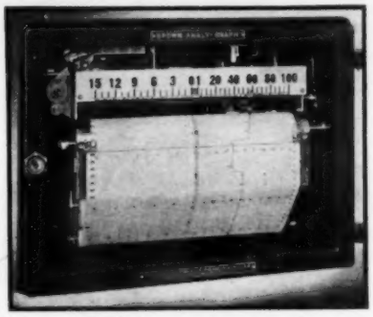
The Type "LG" airless Rotoblast cleaning table recently announced by the Pangborn Corporation, Hagerstown, Md., has eight individual smaller tables which, as they approach the blasting zone, automatically start to revolve, thus presenting every exposed surface of the work placed upon them to the action of the blast. It is claimed that this table is particularly adapted for blast cleaning comparatively frail work, particularly of a flat character.

As in all Rotoblast machines the centrifugal force of a motor driven wheel is used to replace compressed air for throwing abrasive against the work to be cleaned. In this application the Rotoblast is mounted above the rear inclosed portion of the large table in such a position that its blast stream completely covers all parts of the revolving smaller tables.

Brown "Analy-Graph"

The Brown Instrument Co., 4501 Wayne Ave., Philadelphia, Pa., is offering the "Analy-Graph" for furnace atmosphere control. The recording instrument is of the potentiometer type and is equipped with a 12-in. wide chart, graduated so as to render the equipment applicable for measuring atmosphere quality resulting from complete or incomplete combustion, or from dissociation. The equipment operates on the principle of measuring the thermal conductivity of the gas mixture which is continuously drawn from the furnace. If the gas is the result of complete combustion, the thermal conductivity will be less than 1.00 due to the presence of carbon dioxide; while if the sample has been produced by incomplete combustion or by dissociation the thermal conductivity will nearly always be greater than 1.00. The only exception to this will be when there is less than one per cent combustible in the final mixture.

In order to render the instrument equally useful for measuring all types of atmospheres, the chart has been divided into two equal sections, one section is used when combustion is complete, while the other is used when combustion is incomplete. This is accomplished by using different electric sensitivities for the wheatstone bridge. The "Analy-Graph" is particularly adaptable for preheating, hardening and carburizing operations where special gas atmospheres must be maintained around the metals. It does away with guesswork in establishing the atmosphere, and applies potentiometer accuracy to its measurement. The large scale permits operators to observe the condition of furnace atmospheres, even when at a distance from the instrument.

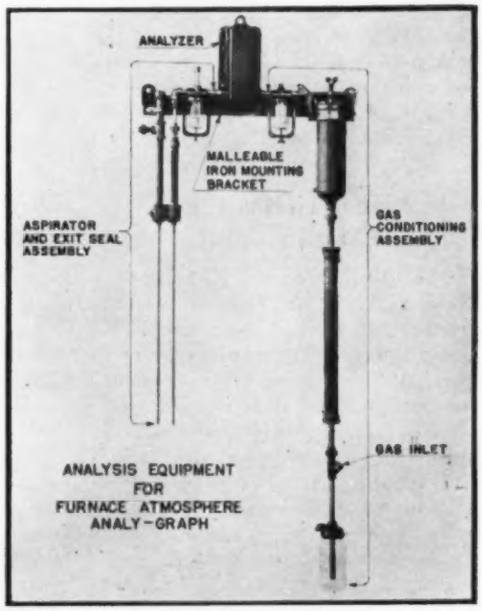


The Analy-Graph recording instrument measures furnace atmosphere quality and permits production of a desired condition

"Durakeen" Broaches

"Durakeen" broaches, offered by the Connecticut Broach & Machine Co., New London, Conn., are a combination of a recently developed steel with a heat-treatment that combines toughness with extreme hardness. They possess the ability to cut the hard alloy steels now being used. It is claimed that these tools are consistent in quality throughout the entire broach and that the surface can be ground away without affecting the tool quality. Abrasion resistance is featured.

These broaches have been successfully used for broaching hard grades of stainless steel and for broaching parts used in the construction of airplanes. "Durakeen" broaches have proven satisfactory for broaching S.A.E. 6150 steel, heat treated to 45 Rockwell.

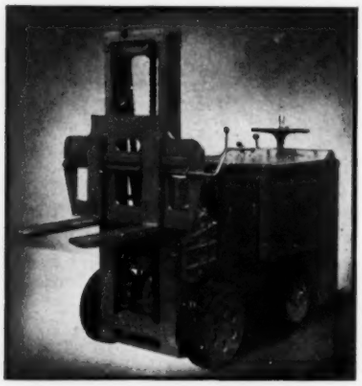


Shop Equipment News

Yale Fork-Type High-Lift Truck

This fork-type industrial high-lift truck offered by the Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa., is particularly adapted for pig handling in metal refining industries. Although the forks are designed for a particular purpose this unit can be used for the pallet system of materials handling.

The forks are designed to grip the pigs firmly and with safety. They can be laterally adjusted by a hand crank for length of pig. The sharp beveled inside edges of the forks enable them to support the pigs by actually biting into the underside curvature of the protruding lip or ear of the pig. This truck has a



maximum capacity of 4,000 lb. and is built to turn around in an aisle only 6 in. wider than the total length of the truck and load.

"Heat Indicating" Efkalin Paint

The Efkalin Co., 804 E. 141st St., New York, N. Y., has announced paints that change color when exposed to heat. These paints are prepared in two types, for exterior or interior use, and it is claimed that they are good for twelve months protection of surfaces upon which they are applied. A series of five permanent-change and seven retroactive-color paints are available. The former change at temperatures ranging from 300 to 734 F.; the latter from 122 to 464 F., with a safety margin of 25 F. Each of the temperature changes is sharp and wide, leaving no room for doubt or question as to the heat of the object to which it is applied. These paints can be used as a warning against over-heating of equipment or as a means of determining that the correct amount of process heat is being applied.

Lyon Stock Cart

This easy-rolling stock car is made by Lyon Metal Products, Inc., Aurora, Ill., and is designed to speed up stock handling and order filling. Its size permits use in aisles between storage bins and provides a convenient means for moving stock from one location to another. The cart is 32 in. long and 16 in. wide. It is equipped with four large rubber-tired casters. The two shelves are 3 in. deep. A third shelf may be added.

Ouellet Combination Angle Plate

This combination angle plate and V-block for tool- and die-makers is being manufactured and marketed for A. F. Ouellet by F. Swenson, 203 Lafayette St., New York, N. Y. The block measures approximately 2¼ by 2¼ in. on each side and is approximately 2½ in. across the bridge. Two ⅜-in. clearance holes are provided and there are twelve tapped holes for mounting clamps and guide blocks. The block is cut from machine-steel bar-stock and is pack-hardened to give a 1/32-in. case all over. It is ground all over, except inside the bridge, after hardening. The tool is square and parallel and the center V

is central and parallel with the sides.

This item is suitable for various inspection and layout operations in addition to the miscellaneous tool and die making operations for which it was designed.

Calite Low-Creep Alloy Castings

The Calorizing Co., Wilkinsburg Station, Pittsburgh, Pa., has developed Calite BL-28 Chromium-Nickel alloy for use as castings in furnace construction. This alloy is of the 25 per cent chromium—10 per cent nickel type and is stable at high temperatures. Ductility tests performed at the University of Michigan showed practically no change in characteristics after heating for 1,000 hours at 1,800 F.

Fafnir Special Pillow Block

The Fafnir Bearing Co., New Britain, Conn., is offering a special roller-bearing pillow block for service involving heavy end thrust in addition to radial load. In this pillow block a separate heavy-duty ball bearing is included as part of the assembly to take the thrust load. Arrangement of the bearings is such that the entire radial load is taken by the roller-bearing while all the forces tending to displace the shaft axially are borne by the ball bearing. A spherical housing construction provides for self-alignment. These pillow blocks are available for shaft sizes ranging from $3\frac{5}{16}$ to 10 in. and with radial load capacities up to 250 tons.

American Machinist — REFERENCE BOOK SHEET

Self-Holding Machine Tapers

Nineteen sizes of self-holding machine tapers selected from the Brown & Sharpe, Morse, and ¾-in. tapers are embodied in this proposed American Standard. Sponsors are the American Society of Mechanical Engineers, the National Machine Tool Builders Association, and the Society of Automotive Engineers

This standard establishes (1) American standard practice for the slope of self-holding machine tapers, (2) the detailed dimensions for this type of taper tool shank, and (3) the corresponding dimensions for the taper socket in the spindle of the machine.

The purpose of a machine taper is to provide a connection between the tool, arbor or center and its mating part which will insure and maintain accurate alignment between the parts and yet permit the parts to be readily separated for reconditioning or for the substitution of other parts.

The name *self-holding* has been given to this series of tapers because, when seated firmly in the socket, they tend to stay in place due to the small taper angle. In the smaller sizes no other means of holding is, as a rule, required. With the larger sizes, while the self-holding feature is still present, the external forces tending to remove the shank from the socket during operations often make necessary a more positive means of locking the shank in place. Removal of the shank from the socket is accomplished by starting it with a drift or some other positive means. The self-holding feature of this series of tapers distinguishes it from the *self-releasing* type where the taper angle is sufficiently large to make the retention of the shank dependent upon a positive locking device, in which case the taper fit between shank and socket serves only to maintain alignment. When unlocked, these tapers will release themselves.

The self-holding taper series consists of nineteen sizes: three small sizes taken from the Brown & Sharpe series having a nominal taper of $\frac{1}{2}$ in. per foot, six sizes taken from the Morse series having a nominal taper of approximately $\frac{5}{8}$ in. per foot, and ten sizes having a taper of $\frac{3}{4}$ in. per foot. The basic dimensions of the tapers comprising this composite series are given in Table 1.

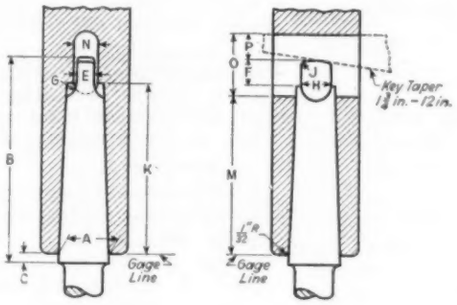


Table 1 Taper Series—Basic Dimensions

No. of Taper	Taper per Foot	Diameter at Gage Line[1] A	Means of Driving and Holding				Origin of Series
			Tongue Drive with Shank Held in by Friction. (*See Table 2*)	Tongue Drive with Shank Held in by Key. (*See Table 3*)	Key Drive with Shank Held in by Key. (*See Table 4*)	Key Drive with Shank Held in by Draw-Bolt. (*See Table 5*)	
239	0.500	0.239					Brown and Sharpe Taper Series
299	0.500	0.299					
375	0.500	0.375					
1	0.600	0.475					Morse Taper Series
2	0.600	0.700					
3	0.602	0.938					
4	0.623	1.231					
4½	0.623	1.500					
5	0.630	1.748					
200	0.750	2.000					¾ Inch per Foot Taper Series
250	0.750	2.500					
300	0.750	3.000					
350	0.750	3.500					
400	0.750	4.000					
500	0.750	5.000					
600	0.750	6.000					
800	0.750	8.000					
1000	0.750	10.000					
1200	0.750	12.000					

All dimensions given in inches.
[1] See illustrations above. Tables 2, 3, 4 and 5.

Table 2 Tongue Drive with Shank Retained by Friction

No. of Taper	Diameter at Gage Line[1] A	Shank		Tongue					Socket	Keyway			
		Overall Length B	Exposed Length C	Thickness E	Length F	Radius of Mill G	Diameter H	Radius J	Depth K	End of Socket to Keyway M	Width N	Length O	Tongue to Bottom of Keyway P
.239	.239	1 9/32	3/32	1/8	3/16	3/16	11/64	1/32	11/16	15/16	.141	3/8	1/8
.299	.299	1 11/32	3/32	5/32	1/4	3/16	7/32	1/32	15/16	1 11/64	.172	1/2	11/64
.375	.375	1 31/32	3/32	3/16	5/16	3/16	9/32	3/64	1⅜	1 13/32	.203	5/8	7/32
1	.475	2⅝	3/16	13/64	3/8	3/16	11/32	3/64	2 3/16	2 1/16	.219	3/4	3/8
2	.700	3 1/16	3/16	1/4	7/16	1/4	17/32	1/16	2⅝	2 1/2	.266	7/8	7/16
3	.938	3 7/8	3/16	9/32	9/16	9/32	23/32	3/64	3 1/4	3 1/16	.328	1 1/16	9/16
4	1.231	4 7/8	1/4	11/32	5/8	5/16	31/32	3/32	4 1/8	3 7/8	.484	1 1/4	5/8
4½	1.500	5⅜	1/4	9/16	11/16	3/8	1 13/64	7/64	4 9/16	4 5/16	.594	1⅜	9/16
5	1.748	6 1/8	1/4	5/8	3/4	3/8	1 13/32	1/8	5 1/4	4 15/16	.656	1½	9/16
200	2.000	5¾	1/4	5/8	13/16	9/16	1 37/64	1/8	4⅞	4½	.656	1 9/16	9/16
250	2.500	6¾	1/4	3/4	1 1/16	11/16	2 1/32	5/32	5⅜	5 1/16	.781	1 13/16	5/8
300	3.000	7⅝	1/4	1	1 1/4	3/4	2 31/64	5/32	6⅜	5 15/16	1.031	2 1/16	3/4
350	3.500	8⅜	1/4	1	1 1/4	7/8	2 15/16	3/16	7 1/8	6⅝	1.031	2 1/4	3/4

All dimensions given in inches. [1] See table 6 for plug gage dimensions.

Tolerances

For Diameter of Shank and Hole at Gage Line (A)
Sizes smaller than No. 1, + .001 − .000.
No. 1 and sizes larger, + .002 − .000.

For Thickness of Tongue (E)
From ⅛ to ¼ inclusive, + .000 − .004.
From 5/16 to 15/16 inclusive, + .000 − .006.
From 1 to 1 inclusive, + .000 − .008.

For Width of Keyway (N)
From .141 to .266 inclusive, + .004 − .000.
From .328 to .484 inclusive, + .006 − .000.
From .594 to 1.031 inclusive, + .008 − .000.

For Concentricity of Tongue (E)
From ⅛ to 15/16 inclusive, .0035 with center line of taper.
From 1 to 1 inclusive, .007 with center line of taper.

For Concentricity of Keyway (N)
From .141 to .484 inclusive, .0035 with center line of taper.
From .594 to 1.031 inclusive, .007 with center line of taper.

Tolerances on Fractional Dimensions + .010 − .010, unless otherwise specified.

In the case of rotating tools or arbors, the spindle imparts motion to these tools and some means must be provided, either friction or a positive drive, to transmit the rotary motion of the spindle to the tool. A positive drive is preferable and may be obtained by providing either a tongue on the shank and a slot in the socket or keyways in both shank and socket with radial keys to transmit the torque.

The tool shank, to maintain proper alignment, must be seated firmly in its socket, and under certain conditions, particularly with the larger sizes, it must be securely locked, so that it will not loosen during the operation of the machine. This may be accomplished by friction or, if a more positive means is required, a hold-back key or a draw

Self-Holding Machine Tapers

bolt may be provided, depending upon the requirements of the particular application.

Tables 2 to 5, inclusive, give the detail dimensions and tolerances for self-holding taper shanks and sockets classified as to (1) the means of transmitting the torque from the spindle to the shank of tool, and (2) the means of retaining the shank in the socket. (Tables 4, 5, 6 and 7 will be published in a second installment.)

The reference gage for American Standard self-holding tapers is a tapered plug gage. Tables 6 and 7 give the dimensions and tolerances for the plug gages applying to this series of tapers.

Nomenclature

Brown & Sharpe taper—A system of tapers originated by the Brown & Sharpe Manufacturing Company with a nominal taper per foot of $\frac{1}{4}$ inch, in which American Standard Tapers Nos. 0.239, 0.299, and 0.375 are based.

Exposed length—The distance the large end of the shank projects from the drill socket or gage.

Gage Line—The basic diameter at or near the large end of the taper.

Holdback keyslot—A keyslot cut through both the socket and tool shank to receive a key which holds the tool in place and may help to drive it.

Keyslot—A slot through the drill shank, drill socket or drill gage.

Key drive—A method of driving the tool by a key through the shank and the collet.

Drift keyslot—A slot through the socket at the small end of the tapered hole to receive a drift or tapered key for forcing drills out of the socket.

Morse taper—A system of tapers originated by the Morse Twist Drill & Machine Company with a nominal taper per foot of $\frac{5}{8}$ in., on which American Standard Tapers Numbers 1, 2, 3, 4, 4½, and 5 are based.

Overall length of shank—Total length from large end of taper to end of tang.

Self-holding taper—A taper with an angle small (or slow) enough to hold a shank in place ordinarily by friction without other holding means.

Slow taper—See self-holding taper.

Tang—The flattened end of the taper shank.

Taper per foot—The difference in diameter between two points 12 in. apart measured along the axis.

Tolerances—The total amount of variation permitted in the size of a part. The tolerances on various dimensions are uni-lateral or bi-lateral as shown with the several tables.

Tongue—See tang.

Tang drive—A means of driving a tool by a tang (or tongue) on the end of the shank.

Basic size—The theoretical size from which all variations are allowed.

Drift or drift key—A flat tapered bar for forcing the drill out of its socket.

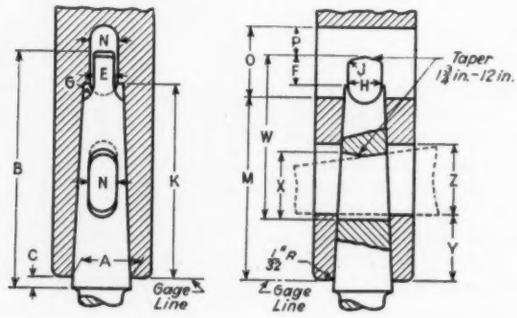


Table 3 Tongue Drive with Shank Retained by Key

No. of Taper	Diameter at Gage Line[1] A	Shank: Overall Length B	Shank: Exposed Length C	Tongue: Thickness E	Tongue: Length F	Tongue: Radius of Mill G	Tongue: Diameter H	Tongue: Radius J	Holdback Keyway—Shank[2]: Small End to Top of Keyway W	Holdback Keyway—Shank[2]: Length X	Holdback Keyway—Shank[2]: Width N	Socket: Depth K	Knockout Keyway[2]: End of Socket to Keyway M	Knockout Keyway[2]: Width N	Knockout Keyway[2]: Length O	Knockout Keyway[2]: Tongue to Bottom of Keyway P	Holdback Keyway—Socket[2]: End of Socket to Keyway Y	Holdback Keyway—Socket[2]: Length Z	Holdback Keyway—Socket[2]: Width N
3	.938	3⅞	3/16	5/16	9/16	9/32	23/32	5/64	2 21/32	1⅛	.328	3⅛	3 1/16	.328	1 1/16	9/16	1⅛	1 3/16	.328
4	1.231	4⅞	¼	13/32	5/8	5/16	31/32	3/32	3 7/32	1 5/16	.484	4⅛	3⅞	.484	1¼	⅝	1½	1¼	.484
4½	1.500	5⅝	¼	9/16	11/16	⅜	1 13/64	7/64	3 13/32	1½	.594	4 9/16	4 1/16	.594	1⅝	⅝	1 11/16	1⅝	.594
5	1.748	6⅛	¼	⅝	¾	⅜	1 15/32	⅛	3⅞	1⅝	.656	5¼	4 15/16	.656	1½	9/16	2⅛	1½	.656
200	2.000	5¾	¼	⅝	13/16	9/16	1 37/64	⅛	3½	1 9/16	.656	4⅞	4½	.656	1 9/16	⅝	2½	1 11/16	.656
250	2.500	6¾	¼	¾	1 1/16	11/16	2 1/32	5/32	3¼	1 9/16	.781	5⅝	5 5/16	.781	1 13/16	¾	2⅞	1 11/16	.781
300	3.000	7⅝	¼	1	1¼	¾	2 31/64	5/32	3 13/16	1 9/16	1.031	6⅝	5 15/16	1.031	2 3/16	⅞	3⅜	1 11/16	1.031
350	3.500	8⅛	¼	1	1¼	⅞	2 15/16	3/16	4½	2	1.031	7⅛	6⅝	1.031	2¼	¾	3 9/16	2⅛	1.031

All dimensions given in inches.

[1] See Table 6 for plug gage dimensions.

[2] Corners at entrance side of Keyways shall be chamfered at 45 deg. as follows: No. 3, 1/64 in. and all other sizes 1/16 in. deep.

Tolerances

For Diameter of Shank and Hole at Gage Line (A)
All sizes, + .002 − .000.
For Thickness of Tongue (E)
From 1/16 to 15/16 inclusive, + .000 − .006.
From 15/16 to 1 inclusive, + .000 − .008.
For Width of Keyway (N)
From .328 to .484 inclusive, + .006 − .000.
From .594 to 1.031 inclusive, + .008 − .000.

For Concentricity of Tongue (E) with Center Line of Taper.
From 1/16 to 15/16 inclusive, .0035.
From 15/16 to 1 inclusive, .007.
For Concentricity of Keyway (N) with center line of Taper.
From .328 to .484 inclusive, .0035.
From .594 to 1.031 inclusive, .007.
Tolerances on Fractional Dimensions + .010 − .010, unless otherwise specified.

The ROUND TABLE

Not Naturalized

Al was opening the mail when Ed entered the office of the small machine shop.

"Looks like old times," observed Ed. "Are those inquiries?"

"Not all," answered Al, "but a big percentage of them are. The trouble is that I can't quote deliveries that will get the orders."

"Why not, Al? You've still got some capacity left. There's no use of turning down business until every machine is running."

"It's not machines, Ed, it's men. A good machinist is harder to find today that a left-handed monkey wrench."

"Didn't I see Joe Caproni come out of this office when I was coming down the street? He worked up at our shop a couple of years ago, and he was a lot better than the average workman."

"I know that, Ed, and judging from his ability alone I could use Joe. In fact he was here looking for a job just now."

"Well, why didn't you give him one?"

"I may be a little old-fashioned, Ed, but you know Joe has been in the country eight years and has never taken out citizenship papers. I figure that when a man settles in a place and earns his living there, it's up to him to become a citizen. If not he has only himself to blame if native or naturalized workers are given preference."

"You're worse than old-fashioned Al; you're stubborn to the point where it hurts your own business. Here's a good man whose work will help the company pay dividends, and you won't put him on just because of some hide-bound patriotic theory."

"I wouldn't mind, Ed, if everyone had a job. But I don't see why a foreigner should be given work when there are still hundreds of citizens on relief."

"Because he has skill which the others haven't, Al. Besides, you're not performing any service to the nation when you make a foreigner stay on relief when he could be put on productive work. I'll go even further and say there should be absolutely no discrimination between men on account of citizenship."

"I think there should be, Ed. If a man stays in this country a term of years and looks to it for a livelihood

there's only two reasons for his not becoming a citizen—either he's careless or he's unwilling to accept this country as his own. In either case he lacks something that will make him the kind of man I want in my shop."

"What a man does outside the shop is his own business. If he doesn't want to become a citizen for one reason or another that's up to him and is no reason for refusing him work. Besides, he is much more likely to seek citizenship if he is given a square deal."

"That sounds fine, Ed, but isn't it up to a foreigner to make the first move? He comes here to make a better living and if he competes for a job against citizens, he should show that he is ready to become one himself."

Is Al right in discriminating against a man because he is not naturalized? Or should skill rather than citizenship determine an employment policy?

Discussion

Something for Nothing

Al proposes to let a stranger come in, take half of the savings, and the men take the other half. Management and capital get practically nothing.

Capital loses out on the above deal. In order to make any changes at all, work must be interrupted long enough to explain to the workers just how the new operations will be performed. The company loses this time while the men are being instructed.

In order to secure increased production it is invariably necessary to speed up machines, and so wear

them out faster; or to take larger cuts, thereby wearing the tools out more rapidly. If only lost motion is eliminated and the man, the tool or machine made available for a greater period, it still follows that tools get more wear per day and consequently cost more per day.

If all this is correct, Al is not doing such a good job for the management in making a 50-50 deal between the workers and an efficiency expert, without considering the capital interest. —JAMES K. MATTER.

Good as New?

A question such as this does not have a universal answer, because it is concerned with the problem of whether a new machine will pay off its cost in a given length of time, or whether an occasional repair is the cheapest.

In one shop where I worked, a lathe was in constant use for a special job. This lathe was built in 1880 and cost approximately $50 per year to keep in repair. An up-to-date machine would do the job no faster nor give better quality. Therefore, the period to pay off the cost of a new machine would be so long as to make the purchase out of the question.

In the case which Al mentions, I believe the proper thing is to overhaul the machine and keep it in use, rather than tie up money that will probably bring better returns in another manner.

—CHARLES R. WHITEHOUSE.

There are some cases in which it will pay to rebuild a machine, but it is extremely doubtful if it will pay in the case of a turret lathe or any standard tool. It is usually in cases where a standard machine is being converted into a special-duty piece of equipment by the addition of permanent fixtures or accessories that the thing will be made to pay. Even then, it will pay to have the rebuilding done by the maker of the machine.

To rebuild a standard machine of any kind simply from a standpoint of putting the bearings in shape, realigning worn parts, or giving it a general overhauling is a mighty poor bet as a money-saving proposition. Money will apparently be saved, but in the long run it will gradually be lost in the later operation of the machine. Those who follow this practice usually do so because they are mechanically near-sighted and do not take time to find out what other machines will do.

It takes some courage and forethought to visualize a broken-down or a wornout machine in the light of an opportunity, but it is an opportunity to make a search of the market to find the best machine for increasing efficiency in that particular plant.

—JOHN E. HYLER,
R. G. Le Tourneau, Inc.

There are innumerable times when the same question is asked, "Should we rebuild that old machine or purchase a new tool? It is necessary to study the following three factors:

1. The first is, "How old is the machine and how much will it cost to rebuild it?"

2. Second, "How many working hours will the machine be subject to and how long will the rebuilt machine last?"

3. Third, "How much in dollars and cents can be saved by the purchase of an up-to-date machine?"

With these three items analyzed, a decision can be made systematically.

So far as the gadgets stuck on new machines are concerned, they all have their purposes and were found to be necessary by years of practical use and engineering. The term "gadgets" is generally used by some "dyed-in-the-wool" shop man who is set in his ways and cannot adapt himself readily to the high-production era. These so-called "gadgets" cost the manufacturer considerable money, not for the part value alone, but for years of development. Any wide-awake manufacturer cannot afford to put so-called "ginger bread" on his product because competition of today is based on merit and price. —JOHN H. DAUM,
Sales Engineer,
The Cincinnati Planer Company.

Something Different

Goods such as radio sets, motor cars and other products are changed yearly to suit the buyers who must have the latest models. In contrast with this attitude the engineer or manufacturer demands efficient performance from a machine, and is not prepared to pay extra for a modified shape or extra trimmings. Changes should only be made when the efficiency of the product can be improved, or when the production costs can be reduced without sacrifice of efficiency.

Sales can sometimes be increased when an awkward looking machine is given a more pleasing appearance. Such changes should be made with discretion and not be frequent. A buyer might make do with an obsolete machine for a number of years, rather than buy a new one which he knows would be superseded soon. In other words, he will wait until the design is stabilized and he can be certain of obtaining the best possible machine. —ROBERT HUTCHESON,
Kenton, Middlesex, England.

I am entirely in agreement with Ed's views, because frequent changes often represent real improvements in design. Although function is the primary aim of most engineers, there comes a time when function alone is insufficient and aesthetic appeal is introduced. Today there is an extensive movement to introduce better appearance in products, and consequently up-to-date designers realize that machinery must be changed to meet the new standards. Moreover, a system of color control is a useful modern development, which while not reducing the number of levers necessary to control a machine, enables these to be more rapidly manipulated. Lighting is also an important factor in machine tool operation, and the extra cost is quickly repaid by increased production.

—A. EYLES.
St. Albans, Hertfordshire, England.

Bonuses for Toolmakers

When it is possible to ascertain the rate of output by time study or calculation, there is little difficulty in establishing a bonus system which is mutually beneficial to employer and employee. Difficulties are met with, however, when these methods are applied to work which is of a non-repetitive character. Owing to the nature of toolroom work, time allowances should be on a much more liberal scale than is usual for repetitive machine-shop work.

In most toolrooms there will be a number of men whose work is of such a varied character that it would be a waste of time to include them in any such system. In these cases it is generally advisable to pay them a bonus equivalent to the average earned by the toolroom as a whole. Experience has proved that where such a system has been adopted, it has resulted in removing a cause of much dissatisfaction among highly skilled men, whose pay envelopes are frequently lighter than those of the unskilled.

—W. L. WATERHOUSE.

VOLUME 81 • AMERICAN MACHINIST, ESTABLISHED 1877 • K. H. CONDIT, F. H. COLVIN, EDITORS • NUMBER 1

Editorials

General Motors Shoulders the Load

EVERY constructive element in American Industry owes it to the General Motors executives to support in every way possible their fight to forestall establishment of a labor dictatorship. These men are shouldering the burden of this struggle for all of industry. If Lewis wins this strike the automobile plants will be operated on a closed shop basis by one man, and the domination will be insured by means of the check-off.

Once a foothold has been established in the automobile industry it will be an easy matter to take over steel, glass and rubber, and after them the rest of the manufacturing industries. Hence the vital importance of meeting the issue while it is just starting.

It is hard for an outsider to see wherein the methods of the Committee for Industrial Organization can possibly lead to legitimate collective bargaining. Thousands of workers who have no desire to strike are being forced off the job by attacks on subsidiary and contributory plants of a highly complex and interdependent industry. Any hardships they may suffer are of no interest whatever to the men who started this strike.

If conditions were bad or wages low in the General Motors plants there might be some justification for a strike. But wages are higher than in most other industries and working conditions are at least as good. Commendable progress has been made in the last year toward reducing the seasonal variations that have lowered the yearly income of a certain proportion of the workers in the industry.

RESOLUTIONS sent by large groups of General Motors employees to their respective managers are good evidence that this strike has not their support. The formation of the Flint Alliance to fight the union drive provides additional proof that the C.I.O. is not engaged in a crusade to assist labor.

Support of the General Motors leaders should not be limited to the ranks of industry, however. Many people outside of industry are going to suffer if the C.I.O. ideals (?) prevail. They will do well to make themselves heard in any way that is open to them. No strike was ever successful when opposed by public opinion.

Horrible Example

THE Soviet Commissar of Heavy Industry has read the riot act to the heads of his factories because of the inefficiency of their operations. He is backed up by the official organ of the group which discloses mountainous wastes of time and money through excessive and useless paper work. And he concludes by ordering these executives, most of whom have been sent to America to study manufacturing methods, to apply them forthwith.

Bureaucracy was the curse of industrial effectiveness in Russia under the Czars, the newspaper correspondent who signs the story remarks, and it still flourishes under the Commissars, despite the most strenuous efforts to eradicate it. Perhaps those who insist that it is inseparable from government ownership and operation of production facilities are right.

Here is a perfect horrible example of what would happen here if bureaucracy were allowed to spread unchecked. The ironic thing about it is that the Russians, who are cited as leaders in economic planning, are urging their operating executives to follow the manufacturing policy of American capitalism.

A New Volume

THIS issue is the first one of Volume 81 of *American Machinist*. The paper was started in 1877 by Horace B. Miller. Jackson Bailey was the first editor. His successors have been Frank F. Hemenway, Fred J. Miller, Frederick A. Halsey, Leon P. Alford, John H. Van Deventer, Ethan Viall.

For the record the present staff is as follows: Kenneth H. Condit and Fred H. Colvin, editors; John Haydock, managing editor; Burnham Finney, western editor; S. Ashton Hand, associate editor; H. R. LeGrand and Ben C. Brosheer, assistant editors; Paul Wooton, Washington representative.

CHIPS

WASHINGTON

President asks Congress for immediate action on stricter neutrality law, calls attention to need for reorganizing administrative machinery which is inefficient, upholds soundness of objectives of NRA but admits failure "because it tried to do too much," lauds accomplishments of inter-American conferences, finds Constitution sound but interpretations very bad indeed . . . Epidemic of plane crashes brings conference of government and air line officials to consider means of increasing safety . . . Department of public works headed by a new cabinet officer being studied by Roosevelt . . . Senator Byrd says his committee will insist on economies as well as efficiency in federal department reorganization . . . White House calls conference on railroad pensions . . . Secretary Roper proposes plant schools to train employees for higher jobs . . . Supreme Court upholds ban on prison-made goods . . . Roosevelt announces that since treaty limitations no longer exist he will go ahead with two new battleships.

FOREIGN

German warship forces release of freighter alleged to be carrying munitions to Spanish rebels . . . Loyalist forces report defeat at hands of 20,000 Nazi fighters . . . Chiang resigns again because of health . . . World warship building race starts as treaty expires and Great Britain lays keels for two 35,000-ton battleships . . . Italy and Great Britain reach agreement to protect status quo in Mediterranean, France sympathetic . . . Nazis say they will not permit a Red government to rule Spain . . . Basques warn German warships to stay out of gunshot of Bilbao . . . German cruiser captures another Spanish merchantman, as rebel gunboats seize Russian ship carrying munitions . . . Nazi newspapers publish attacks on Spanish government . . . More German and Italian volunteers land in Spain.

FINANCE

Railroad earnings highest since 1930 . . . I.C.C. vigorously attacks law taxing undivided profits as unsound . . . Treasury reports per capita debt at $266.96 up $4.50 . . . Roosevelt offers budget with a reduced deficit, balance in sight for next year.

INDUSTRY

General Motors closes plants and cancels parts orders as glass supplies run low and sit-down strikes cripple several units . . . Lackawanna buys 5 passenger locomotives from American Locomotive Co. . . . New York court orders garment firms that left city in violation of contracts with workers to return or get out of the industry . . . Supply industries slow down and start laying off men as auto strike curtails releases . . . Unorganized General Motors employees join in protest against C.I.O. action, petition Roosevelt to stop strike, send resolutions to Corporation expressing satisfaction with conditions of work and wages . . . A.F. of L. unions protest strike.

INDICATORS

Steel production drops as automobile companies reduce requirements . . . Electric power output declines in sympathy . . . Business Week's index recedes nearly a point to 83.

Industrial Relations to Be Management Group's Topic

Aware that industrial relations are now of major importance in general management, the personnel division of the American Management Association has called a three-day conference in Philadelphia, February 9-11. The theme of this 15th annual meeting of the division will be "Industrial Relations: A 1937 National Problem."

Outstanding speakers during the three days include: Clarence G. Stoll, Western Electric Company, Inc.; C. S. Ching, United States Rubber Company, W. L. Batt, president, SKF Industries, Inc.; W. H. Winans, Union Carbide Company; W. G. Marshall, Westinghouse Electric & Manufacturing Company; J. W. Dietz, Western Electric Company, Inc.; Edgar J. Kaufmann, Kaufmann Department Stores, Inc.; E. S. Cowdrick; A. V. Miller of the New York Tribune, Inc.

The dinner on Wednesday will be addressed by Virgil Jordan, president of the National Industrial Conference Board, Inc., on "The Economic Outlook As It Affects Industrial Relations and the Division of Income."

During the three-day conference the speakers and discussions will center upon: facing the problem of human relations in industry and commerce in 1937 and what a practical management attitude should be; worker-management contacts, and how specific situations can be met; social security and the new problems that face administrative executives, together with practical solutions; wage negotiation within the limits set by legislation and public opinion, and yet without taking a disadvantageous position; extra pay, and what mistakes should be avoided; developing executives, and what is new in this field.

Power Industry Will Put Half Billion Into New Plant

The electric power and light industry will spend $635,000,000 in 1937 for new construction and maintenance, according to *Electrical World's* annual statistical issue of January 2. A minimum of $530,000,000 will go into new capital equipment, 60 per cent more than was spent for this purpose in 1936. Construction of new generating equipment will be double that of 1936. Distribution systems will be expanded by over 40 per cent. Power transformers will keep step with generating equipment. Welding equipment and industrial heating apparatus are due for from 40 to 50 per cent increase.

Machinery Exports Had Great Advance in 1936

Exports of machinery constituted one of the prime factors in United States export trade expansion during 1936, according to the Foreign Commerce Department, Chamber of Commerce of the United States. Sales abroad of American machinery for the nine months of 1936 amounted to $245,906,000 or 27 per cent greater than for 1935. Electrical machinery and apparatus exports increased 20.7 per cent. Foreign sales of agricultural machinery and implements were 29.4 per cent greater than a year ago.

The heaviest increases in value were in power-driven metal-working machinery, 77.3 per cent. Exports of gear-cutters increased 83 per cent in quantity above 1935; lathes, 97.4 per cent and milling machines, 47.6 per cent.

Well and refinery machinery exports increased 23.3 per cent in value; construction and conveying machinery, 41.5 per cent; mining and quarrying machinery 5.2 per cent and textile machinery, 44.7 per cent. The number of stationary and portable internal-combustion engines exported increased 25.8 per cent over the 1935 nine months; sewing machines, 34 per cent; typesetting machines, 21.7 per cent; and adding, accounting and calculating machines, 21.9 per cent.

McGraw-Hill Inaugurates a 25-Year Service Club

Forty-seven persons received membership in the McGraw-Hill 25-Year club inaugurated on December 31. James H. McGraw, Jr., chairman of the board, McGraw-Hill Publishing Company and the McGraw-Hill Book Company, entertained 300 guests at a buffet luncheon at which Martin Foss, president of the Book Company, was the honored guest. Mr. Foss just completed 30 years service.

Only seven of the 47 club members have been with the company a mere 25 years. Including James H. McGraw, founder, eleven members have 40 to 50 years service records. Malcolm Muir, president, has also been with the publishing company longer than a quarter century.

Knows Machine Tool Field

TELL BERNA

Tell Berna Made General Manager of N.M.T.B.A.

C. R. Burt, president of the National Machine Tool Builders' Association, announces the appointment of Tell Berna of Cleveland, as general manager of the Association from January 4th. Mr. Berna is a graduate of Cornell University with a degree of mechanical engineer. He has been general sales manager of the National Acme Company of Cleveland for the past six years, and prior thereto was successively sales manager for the Union Twist Drill Company of Athol, Massachusetts; the G. A. Gray Company of Cincinnati; and manager of the Cincinnati office of Cutler-Hammer, Inc. of Milwaukee.

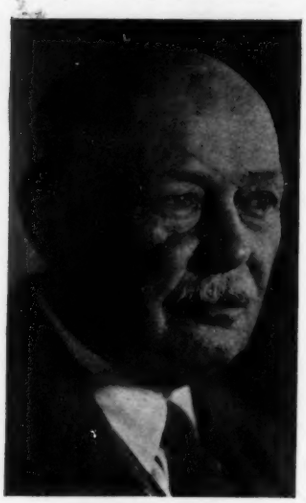
Mrs. Frida F. Selbert continues as secretary of the Association.

Mr. Berna succeeds Herman H. Lind who was general manager of the Association from 1932 through 1936 and is now executive vice-president of the American Institute of Bolt, Nut & Rivet Manufacturers.

Foundry Equipment Show Scheduled for May 3-7

Better business being enjoyed by the foundry equipment industries is influencing the unusual rate at which exhibition space is being taken for the 41st Annual Convention and Foundry Show sponsored by the American Foundrymen's Association. This year the show will be at the Milwaukee Auditorium, Milwaukee, from May 3-7. W. F. Bornfleth, of Cutler-Hammer, Inc., is the general chairman of the convention committee.

Built Steam Turbines



J. F. MAX PATITZ

J. F. Max Patitz Dies, Allis-Chalmers Engineer

J. F. Max Patitz, chief consulting engineer, Allis-Chalmers Mfg. Co., Milwaukee, died suddenly of a heart attack January 3. He was associated with Allis-Chalmers for more than 51 years, nearly 26 years of which he served as consulting engineer.

Mr. Patitz was born at Mugeln, Saxony in 1866. He entered the employ of the E. P. Allis Company in June 1885. His native ability was soon recognized both by E. P. Allis and the late Edwin Reynolds of steam engine fame, and he was transferred to the engineering department. In 1901 when the E. P. Allis Company became part of the Allis-Chalmers Company, he was placed in charge of the building of steam engines and compressors. As early as 1899 Mr. Patitz saw the possibilities of the steam turbine and did much to further the building of steam turbines by the company.

Venezuela Desires Data on American Machinery

Venezuela's Ministry of Fomento has asked the Machinery Division, Department of Commerce, to notify all American engineers and machinery constructors that it is anxious to obtain all available information on American equipment "for the installation of small or medium-sized industrial enterprises for the manufacture of the natural products of the country." Heretofore, such opportunities as existed in Venezuela were for export sale of industrial installations completely equipped for production and have not attracted much attention in America.

Exports of Machinery During November, 1936

	November 1936	October 1936	November 1935
Electrical machinery and apparatus	$7,630,837	$8,818,945	$7,475,827
Power generating machinery (except automotive and electric)	683,012	837,195	665,668
Construction and conveying machinery	711,689	1,636,385	763,778
Mining, well and pumping machinery	2,859,878	3,343,102	2,464,969
Other metal-working machinery	250,373	290,633	348,243
Power-driven, metal-working machinery	3,785,013	3,883,006	3,923,375
Textile machinery	773,359	1,569,452	915,667

Exports of Metal-Working Machinery During November, 1936

	November 1936	October 1936	November 1935
Engine lathes	$163,545	$129,749	$128,717
Turret lathes	165,383	224,707	107,523
Other lathes	113,970	183,983	104,224
Vertical boring mills and chucking machines	167,253	384,243	130,647
Thread cutting and automatic screw machines	198,512	323,599	268,834
Knee and column type milling machines	118,212	99,882	90,736
Other milling machines	222,207	222,407	358,428
Gear cutting machines	96,275	245,177	175,200
Vertical drilling machines	106,768	71,969	220,119
Radial drilling machines	67,909	41,749	11,413
Other drilling machines	175,185	112,792	226,446
Planers and shapers	25,677	54,687	71,227
Surface grinding machines	97,639	85,514	194,404
External cylindrical grinders	73,555	104,143	80,061
Internal grinding machines	270,806	47,294	198,086
Tool grinding, cutter grinding, and universal grinding machines	218,112	109,835	250,699
Other metal grinding machines	112,142	126,901	59,088
Sheet and plate metal working machines	410,930	328,031	193,127
Forging machinery	174,388	127,036	113,787
Rolling mill machinery	236,763	192,978	246,270
Foundry and molding equipment	63,389	95,621	328,883
Other power-driven metal-working machinery and parts	507,393	370,716	365,456
Other Metal-Working Machinery			
Pneumatic portable tools	67,858	84,619	67,385
Other portable and hand and foot operated metal working machines and parts	58,602	76,014	81,349
Chucks for machine tools	21,530	21,030	25,415
Milling cutters, machine operated threading dies and taps and similar machine-operated metal cutting tools	52,180	53,123	123,698
Other metal-working machine tools	50,203	55,847	51,078

Penn Electric Switch Builds Modern Factory

A modern factory building, 210x 340 ft., is nearing completion at Goshen, Ind., for the Penn Electric Switch Company, where headquarters will be established about Feb. 1. The company manufactures automatic controls for heating, refrigeration, air-conditioning and air-conditioning equipment for the pump and air compressor industries. The entire factory building will be cooled in summer by fan units through which water will circulate at 53 F. The Austin Company is the builder. Officers are: Albert Penn, president; M. L. Henning, executive vice-president, and Mark D. Disoway, works manager. Approximately 350 people will be employed.

Egypt Wants American Flour-Milling Machinery

Egypt is again in the market for American machinery. The new demand is for flour-milling machinery. The Egyptian Ministry of Commerce and Industry has announced, says a report of the Machinery Division, Department of Commerce, that it is preparing plans for a grain elevator with a capacity of 27,000 metric tons in Old Cairo. The project will include equipment for cleaning, drying and disinfecting of the grain.

Donald Blanchard To Aid S.A.E. Engineering Contacts

Donald Blanchard has resigned as editor of the *Automobile Trade Journal* to become secretary of the Society of Automotive Engineers' Engineering Relations Committee. The announcement that Mr. Blanchard has joined the S.A.E. headquarters staff was made by John A. C. Warner, secretary and general manager.

The committee is charged with supervision of all contacts between the S.A.E. and outside agencies and was organized about a year ago. The need has become great for a more thorough contact between automotive engineers and technicians on administrative and regulatory agencies to remove technical safety matters from the argumentative class by providing an uninterrupted supply of needed engineering facts. It is to this task Mr. Blanchard will devote himself.

DETROIT Letter

Strike viewed as embarrassing to Lewis, who gets digs from Green . . . Each side tests other's strength as G.M. goes down . . . Washington has not revealed its hand . . . Glass shortage grows

DETROIT—Strike troubles have developed so rapidly in automotive circles the past 10 days that motor executives and probably John L. Lewis too are a bit dazed. Ever since collective bargaining became an issue in the early days of NRA and the unions were given a new lease on life, the industry has felt that some day it would have to fight a decisive battle over the open vs. the closed shop. That day is here. It came with such suddenness that both sides were caught unprepared.

Zealous Lieutenants

There is considerable evidence to support the statement that Mr. Lewis would have preferred to wait at lease a few months before engaging in a struggle which will have an important bearing on his own future as well as on the future of his Committee for Industrial Organization. It appears that his zealous automotive lieutenants moved a little too fast and before he knew it he found himself out on a limb. The only thing to do under the circumstances was to make as big a rumpus as possible. This he proceeded to do through the United Automobile Workers by crippling General Motors production by strikes.

The crux of the matter is whether the U.A.W. shall be recognized as the sole bargaining agency for all General Motors employees. Homer Martin, union president, disclaims any thought of seeking a closed shop. Yet it is impossible to find anyone in Detroit who does not believe that the next step sought by the union after recognition as the sole bargaining agency would be employment of only union men. It can be said positively that General Motors is adament in its refusal to deal exclusively with the U.A.W. In that position it has the wholehearted support of the entire industry, including Ford.

Despite the efforts made by Governor Frank Murphy and James Dewey of the U. S. Department of Labor to get General Motors and the U.A.W. into a joint conference, the situation still has the aspects of a "knock-down" fight to the finish. Both sides have too much at stake to settle without thoroughly testing each other's strength. Mr. Lewis will lose face if he is defeated or if he gains a wishy-washy victory. Only a thumping triumph will do him much good. If he wins a notable victory, the next step probably will be to crash down on Chrysler and then to go after Ford. Incidentally Mr. Martin is believed to be doing some tall bluffing in referring to a "satisfactory understanding" between the union and Chrysler. If there is such a private agreement, the fact is belied by the actions and words of high Chrysler executives. That the union has been able to make agreements with some independent compaines, such as Nash and Studebaker, has long been common knowledge in Detroit.

Seemingly Washington is remaining aloof from the squabble, except to send mediators to try to get the two sides together. On the other hand, automotive brass hats haven't forgotten Mr. Roosevelt's campaign speech in this city in October when he told thousands of workers that the motor industry was paying them larger incomes, but what they were receiving was not enough. Perhaps it is only a coincidence that figures revealing the salaries of top G.M. executives were made public at the moment when the strike situation was getting hot the past week, but Detroit doesn't think so. Madame Secretary Perkins rushed into print with a criticism of President Sloan's statement outlining G.M.'s strike position. It is no secret that Mr. Sloan is one of the administration's pet peeves.

Perhaps it is only a product of strike hysteria, but an interesting story is making the rounds by Detroit's "grapevine telegraph." It is to the effect that if the strike causes too much distress around the country and possibly spreads beyond G.M.'s ranks to other major companies and if car makers take too stiff-necked an attitude, President Roosevelt will threaten to ask Congress to put the industry under federal regulation in the public's interest. That may be outside of Mr. Roosevelt's conception, but it is known that some people in the industry fear it might happen.

A Bad Impression

Observers feel that General Motors has made some serious tactical blunders. No useful purpose was served by securing an injunction to oust sit-down strikers in Flint, especially since the men are still in the two Fisher plants there. It gave the impression that the corporation was ready immediately to resort to force. W. S. Knudsen, G.M.'s executive vice-president, declared that union

Detroit, January 11—Attempts to get General Motors and Union officials together for a joint conference were broken off early Sunday morning when the situation seemed hopelessly deadlocked. General Motors insisted upon unconditional withdrawal of sit-down strikers before it would enter into conversation. The Union refused this demand insisting that General Motors promise not to try to reopen plant or transfer machinery from one plant to another. Meanwhile sentiment among non-union employees who want to return to work is rapidly crystallizing. The outlook for solution of the strike in the immediate future is dark unless the White House intervenes. Prevailing opinion is that Mr. Roosevelt will not step in unless the strike spreads beyond General Motors. Car production will not be seriously affected by the strike until this week.

Chrysler has posted notices in all plants outlining its stand on collective bargaining and taking a position almost identical with that of General Motors.

representatives should bargain collectively on matters of hours, wages and working conditions with local plant managers familiar with local affairs. General Motors' policy of decentralized management called for such procedure. A few days later Nicholas Dreystadt, general manager of Cadillac, is reported to have told a union committee that he would take up their demands with Mr. Knudsen. This supported the union's contention that plant managers have no real authority. In fact, it is obvious that before the strike ends, an agreement on some sort of terms must be made between G.M.'s top management and the U.A.W.

How much strength has the union? It is hard to say, but it certainly is considerably less than a majority of the workers. The largest G.M. city is Flint, with 46,000 workers in five G.M. factories. It is reliably reported that union membership there is less than 5,000, most of the members being in the two Fisher Body plants. In some spots the union admittedly has a large following. Probably 85 per cent of the employees of the Chevrolet and Fisher plants at Norwood, Ohio, are union members. The union claims 100,000 members in the entire industry, including parts factories. Invariably the union signs up large numbers in the early days of any strike, and this strike is no exception to the rule.

Sentiment among workers at Flint is said to be strongly anti-union. Some G.M. employees were so resentful at having to be laid off that they threatened to march to the Fisher factories and attempt to eject the sitdown strikers. Cooler heads prevented this action. The Flint Alliance has been formed by Flint citizens for the purpose of rallying those opposed to the strike who wish to return to work. The alliance is seeking signatures of G.M. workers. The union refers to the newly-formed organization as a vigilante group which is bent on "smothering the strike movement" by strong-arm methods. The union charges that General Motors has been circulating petiions among workers for their signatures stating that they are satisfied with wages, working conditions and collective bargaining arrangements. In some cases men have been discharged because they didn't sign, it is claimed.

Strikes have effectively paralyzed General Motors. Almost all of Chevrolet, including the engine plant at Flint and the local gear and axle plant, is down because of lack of bodies or because sufficient parts have been built ahead for a month's supply. Buick hasn't assembled cars for more than a week, although some parts departments are operating. Olds and Pontiac can run the early part of this week, but will have to stop assemblies in a few days because of shortage of parts. Pontiac, however, will keep 75 per cent of its men at work building up a backlog of parts, particularly castings. Cadillac was closed by a sitdown strike last Friday morning. Delco-Remy is down flat. Ternstedt and AC Spark Plug are on part-time schedules. General Motors Truck has curtailed production because of a glass shortage.

Cold Glass Furnaces

Aside from the G. M. strikes, the industry has a major worry in a threatened shortage of glass. After an impasse which lasted for several weeks, direct negotiations were resumed Monday between Libbey-Owens-Ford and officers of the Flat Glass Union and a solution is likely to be reached soon. A settlement of the Pittsburgh Plate Glass strike also appears imminent. If Pittsburgh remains closed, Chrysler will be the worst sufferer. The automobile union would prefer to see Chrysler able to continue work during the G. M. strikes, thus making General Motors squirm as it watches its competitors take business away from it. The U. A. W. believes it can bring General Motors to terms more quickly that way than if automotive plant shutdowns became general. Most furnaces of both Pittsburgh and Libbey are cold and it will take five to six weeks to heat them to a point where the quality of glass produced is up to the

Industrial Review

- Although the strikes that are crippling the automobile industry in and around Detroit are disturbing to most men in the machinery and machine tool industries their effect on machine tool orders and inquiries has been negligible so far. Prices increases and long deliveries have combined to keep both orders and inquiries decidedly active.
- In the Eastern territory no change is noted from the highly satisfactory rate of activity that characterized last few weeks of 1936. Pittsburgh distributors say that their volume has not been affected by the automobile troubles and that for the moment the labor situation in the steel plants seems to be well in hand. Glass strikes, however, has been disturbing. Prospects for January business are very good.
- In Detroit where the difficulties are concentrated the shutdowns of plants have naturally affected supply business and have postponed immediate deliveries of machinery, but there is every expectation that this lull will be followed by a vigorous upswing as soon as a settlement is reached. Toledo reports much the same situation. Inquiries are continuing to come in although there is some feeling that the active business stimulated by price increases may be followed by something of a lull. Early settlement of the local glass strike is anticipated. In Cincinnati business continues to be exceptionally good. Machine tool builders are oversold for months to come on most models and report that the first part of January is bringing in a lot of additional business. The opinion is expressed that price increases will not result in any loss of business this spring.
- The year has opened up very well in St. Louis and the present satisfactory rate of activity is expected to continue for several months unless there is some major upset. Chicago reports equal satisfaction with things as they are and looks for the best first quarter since the beginning of the depression. One Milwaukee company reports that one or two machines have been held back because of the automobile strike, but is finding general business on the upgrade.
- Major labor disturbance of the Pacific coast, the maritime strike, remains unchanged with waterborne commerce valued at $7,000,000 per day still at a standstill.
- Steel bookings for the first week of the year were the largest since early September with demands heavy for all types of industrial steel. Reinforcing material at most mills is almost booked already for the first quarter of the year.

proper standard. Rough glass in stock at these two companies, however, is estimated at a month's requirements for the motor industry. This glass merely has to be ground and polished and deliveries can begin within a few days after work is resumed.

Unless the glass strikes end, many car makers will have to curtail car assemblies shortly. Chrysler has been running hand-to-mouth so far as glass stocks are concerned. It was saved from a shutdown last week by receipt of foreign glass. Whether further deliveries from Belgium, in the absence of a domestic glass supply, will be sufficient to keep Chrysler operating is problematical. Ford has its own glass plant at Rouge and another at St. Paul which it is reopening. It also has a substantial stock of finished glass on hand.

Ford Seems Immune

What about chances for unionization of Ford? They appear slim, unless the U.A.W. should win an overwhelming victory in the G.M. strikes. The Ford program of scattering small parts factories around the countryside makes the task of union organizers exceedingly difficult. It is Ford's plan to expand the number of these small plants as rapidly as possible. However, the fact remains that employment at Rouge still constitutes more than 95 per cent of Ford's workers in southern Michigan. The union hasn't been able to make even a dent at Dearborn. Some people attribute Ford's freedom from unionization to the efficiency of the famed Harry Bennett and his service department in keeping Ford plants cleared of agitators. A better reason is that Ford workers have the highest minimum wage in the industry ($6 a day). At a time when unions are pushing for a 30-hour week, Ford admits, through W. J. Cameron, that the six-hour day is on the way. Mr. Cameron, no doubt reflecting the views of Henry Ford, says that industry isn't yet prepared for this step, but should be before long. Mr. Cameron's statement is taken to mean that Ford will not immediately go to the six-hour day, as rumored, but observers wouldn't be surprised if a seven-hour day were adopted soon. At the same time the minimum daily wage might be boosted.

William Green is getting in licks at John L. Lewis in the General Motors strikes by having president of various A. F. of L. craft unions telegraph protests to General Motors against any agreement by the corporation which might make the U. A. W. the sole bargaining agency for all employees. The Metal Trades Department of the Federation went so far as to instruct its members who are idle because of the strike to seek such work with General Motors as they can. They are not expected, however, to break through picket lines or work in plants operated by strike-breakers (General Motors is making no attempt to operate any strike-closed plant). The U. A. W. points out that the craft unions have only a thimbleful of members in the motor industry and the protests addressed to General Motors are only an attempt on Mr. Green's part to embarras Mr. Lewis at every turn. The situation is complicated by the fact that the Federations of Labor in Flint, Detroit and Cleveland, all of which are in good standing with the A. F. of L., have unanimously endorsed the G. M. strikes. In fact, Frank Martel, president of the Detroit Federation, is on the automobile union's strike strategy board. One can't blame the A. F. of L. for feeling bitter about developments. It is said to have spent $300,000 out of its general treasury to nurse along the U. A. W. during its infancy only to have Mr. Lewis snatch it away last May.

Impossible Demands

The U.A.W. is asking for several concessions which General Motors will refuse to grant. The corporation probably will stand by its present program for a 40-hour week with time-and-a-half for overtime. The union wants the 30-hour week. Mr. Knudsen says that if the 30-hour week ever should come, the industry will have to purchase a large amount of new high-productive, low-cost machinery. The union is not seeking an annual wage, which heretofore has been named as one of it's major aims. It recognizes the seasonal character of the industry and believes that the same objective as an annual wage might be accomplished by establishment of high minimum hourly rates so that men can earn enough during the active production season to tide them over layoffs in the tooling periods. The union differs with General Motors on seniority rules. It maintains that seniority should be based solely on length of service, whereas the corporation is committed to the rules laid down by the defunct Automobile Labor Board calling for first consideration to be given to workers with dependents.

G.M. Holding Bag

Momentarily all the industry is benefiting at the expense of General Motors, since it is the only idle company. The situation may be changed by a glass shortage before Pittsburgh and Libbey can get back into production. If that happens, everybody except Ford will be in the same predicament. General Motors, with the exception of Cadillac and General Motors truck, has about a three weeks supply of glass. Unless the strikes last longer than a month —production and sales for the year aren't likely to be affected adversely. Car assemblies will be much slimmer than anticipated this month and next, but the industry should operate full tilt in March, April, May, June and possibly July. The production and selling season for 1937 models will be prolonged through the summer at a higher rate than earlier projected. It is not believed, however, that the fall introductions will be postponed. The Automobile Manufacturers' Association has announced the New York Show for the week of October 27, which is the earliest on record. The industry has gone into the strike period in the midst of a new car shortage, with dealers understocked.

At a time when automobile glass is getting so much attention, it is of interest to note that Ford is reputed to have developed an efficient method of laminating safety glass which provides for polishing only the outer sides of the two glass sheets, thus reducing substantially the cost of production. The Dupont interests are reported offering a synthetic glass which is flexible, but at present requires extreme care in handling. It is possible that one car company may adopt this glass as standard equipment next year.

The U. A. W. is guilty of inconsistency or it believes that its strength will increase more rapidly than appears likely. Although it admits it does not have a majority of G. M. workers in its ranks, it wants to be the sole bargaining agency for all employees. While making this demand, it also says that it is willing to abide by the rulings of the National Labor Relations Board. It has been the policy of that Board to hold plant elections under its auspices and the group winning a majority is recognized as spokesman for all workers in the plants. If such plant elections were held today, it is a safe bet that the U. A. W. wouldn't win a majority vote in most G. M. factories.

Watching WASHINGTON

President proposes balanced budget by 1939 . . . . Result depends on industry's absorption of unemployed . . . . Annual message contains criticism of courts . . . . Two new battleships to be built

WASHINGTON — Those prognosticians who foresaw that President Roosevelt would lean away from the left upon reelection found support for their predictions in the events of last week. In most instances, their opinion was based on the thought that during his first term a president with a flair for practical politics would strive for a second term but that during his second term he would strive to make history.

For there is little doubt that President Roosevelt has an unparalleled opportunity to make history and that he is conscious of this fact. If we disregard all diverse doctrines as to the cause and effect of economic swings, the record still shows that his first four years of office did see a rise from deep depression to prosperous proportions in most lines of business activity. Now the opportunity remains to demonstrate whether government can so influence events that the upward swing will not surge past a stage of stability to be followed by a new catastrophic upheaval.

Budget Balance "If"

Outstanding among the President's pronouncements to Congress were those expressing his determination to balance the federal budget and to preserve the present mode of government within the limitations of the Constitution. In his budget message he indicated the possibility of bringing the federal books into balance for the fiscal year 1938 except for debt reduction of $401,515,000 and into complete balance for the fiscal year 1939.

Encouraging as this announcement appeared to industrialists and others who were frankly disturbed by mounting federal outlays with little evidence of a desire to keep them within the limits of income, the President's message was hedged about with many "ifs". First of these is the larger revenue, which must jump nearly one and a half billions for the fiscal year 1938 over 1937 in order to bring about the indicated results. Next, the budget did not include a relief estimate. Without this it showed a surplus of $1,135,607,943. The President evidently expects the relief figure to exceed this amount but specifically expressed his hope that it would not go beyond $1,537,123,000 which represents the surplus shown plus the allocation for debt retirement.

A third "if" is that business employ men and women in larger numbers than it did last year. Specific in passing the buck back to business was the statement that "if every employer will undertake during the next six months to give employment to persons now receiving government help, the national budget can thereafter be kept definitely in balance." One more element of doubt in securing the fiscal goal desired is the possibility that Congress may again seek to expand governmental activities thus increasing outlays of public funds. The President pointed out that any such new projects should include provision for raising the revenue to cover their cost.

Big Defense Item

Within provisions of the budget was the nation's greatest outlay for peacetime defense totaling approximately one billion dollars. The Navy is to receive $587,302,600 and the Army $393,460,400 in addition to items for non-military War Department activities and improvements to rivers and harbors. Included in the naval appropriation is the cost of two new battleships to replace obsolete fighing units in service for 26 years.

While his annual message to Congress disclosed a decision to formulate legislation within the structure of the Constitution, the President's impatience with judicial restrictions was thinly veiled. Repeated references to the judiciary and judicial branch of the government served in lieu of direct comments concerning the Supreme Court, but the inference was there. Other than to assert the determination to work through the Constitution with "an increasingly enlightened view in deference to it," rather than by amendment, the message reflected practically no deviation from past New Deal policies. NRA was mentioned with the statement that its difficulties rose from the fact that it had attempted to do too much. However, it was pointed out, the problems which NRA attempted to solve are still with us, and the President implied that something would be done about them.

O'Mahoney Bill

Of the many possibilities for increased control over business is Senator Joseph C. O'Mahoney's bill for national incorporation. In drafting this proposed legislation Senator O'Mahoney attempted to make it conform with the decision written by Supreme Court Justice Sutherland which upheld a law protecting the state of Ohio from the sale within its borders of goods manufactured by convicts in other states. Carrying out this principle, the Senator believes that similar protection can be obtained against child labor and adult labor not properly compensated. The bill would exert the full authority of federal law to improve labor standards and corporate practices and in addition extend the cooperation of the federal government to those states which are enacting labor legislation. So far as the child labor provision is concerned this may prove redundant of governors and governors-elect comply with the letters sent to nineteen states by the President asking them to obtain ratification of the child labor amendment now before them. The assent of twelve more states is needed for adoption.

First of the enactments of the new Congress was its export embargo on arms to Spain. Becoming effective with the President's signature on January 8 this resolution was followed by voiding the licenses already issued for such exports.

American Chain Adopts New Corporate Name

Long recognized as the world's largest manufacturer of chains for all purposes, the American Chain Company has since 1924 become a leader also in the production of wire rope or cable. It was this fact that caused the directors to enlarge the name to American Chain & Cable Company, Inc.

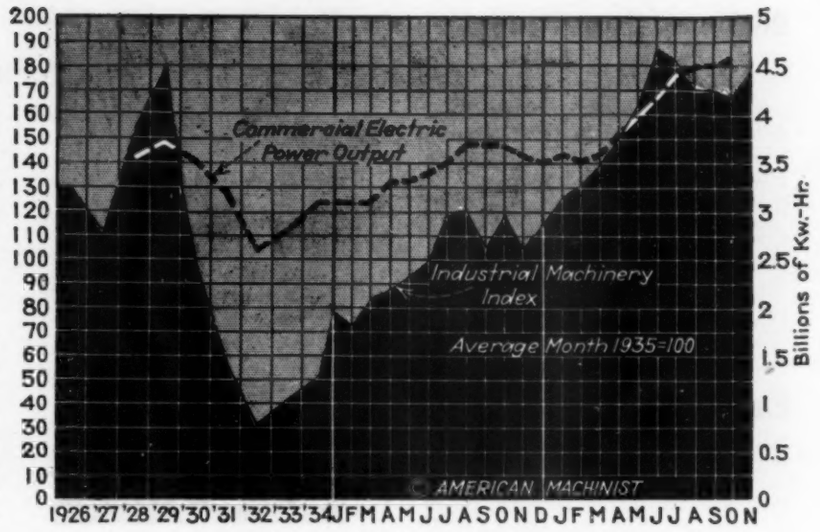
The American Chain Company first became a factor in the wire rope or cable industry through the acquisition of the American Cable Company and the invention of a preforming principle in wire rope construction in 1923. Several years later it acquired by purchase the Hazard Wire Rope Company. The Company's familiar trade mark, known as the "Acco Giant" will be retained as a common symbol of quality by the American Chain & Cable Company and its several divisions. The general executive offices will remain at Bridgeport, Conn., and 230 Park Avenue, New York.

The directors recently elected W. B. Lashar, chairman of the board; W. T. Morris, president; Wilmot F. Wheeler, executive vice-president and treasurer; A. P. Van Schaick, vice-president in charge of sales; C. G. Williams, vice-president in charge of production; W. M. Wheeler, secretary; Frederick C. Geir, assistant secretary, and Stanley Mann, comptroller.

Back in 1904, Mr. Lashar, the chairman, investigated the tire chains being made by H. D. Weed, entered into a royalty agreement with him, and started the old Weed Chain Tire Grip Company in New York City. At that time Mr. Morris joined the company and is now its president. Started in a single room, the American Chain & Cable Company today produces 137 widely known products in twelve divisions and associate companies.

Perkin Medal Awarded to Thomas Midgley, Jr.

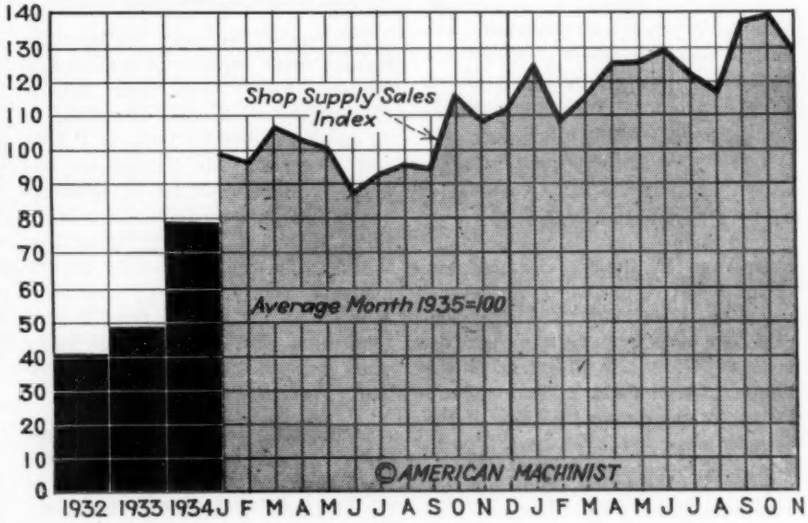
At a joint meeting of the American Section of the Society of Chemical Industry and the American Chemical Society, held in New York on Jan. 9, the Perkin Medal for 1937 was presented to Thomas Midgley, Jr. of the Ethyl Gasoline Corporation. The award was made for the development of anti-knock gasoline. James G. Vail, chairman, presided.


Commercial Electric Power Output
Industrial Machinery Index
Average Month 1935=100
Billions of Kw.-Hr.
AMERICAN MACHINIST
1926 '27 '28 '29 '30 '31 '32 '33 '34 J F M A M J J A S O N D J F M A M J J A S O N

Orders for Industrial Machinery Rose in November

After sliding slowly down hill from the July peak, orders for industrial machinery improved measurably in November, reaching a figure of 177.5 as compared with 186 in June and 168 in October. Possibly the November preliminary figure may be a little high because three of the seven constituent factors are still missing. One of them, electric motors, was largely responsible for the low record of October.

This month's comparative curve, the output of commercial electric power, has maintained its steady upward trend, being now 35 per cent above the 1935 average and 24 per cent over the 1929 figure.



Sales of Shop Supplies Decline Seasonally

October was the 1936 peak for shop supply sales. There was a 10-point drop in November, from 138 to 128, and it is to be expected that December will see a further seasonal recession. All four factors were down.

Oil Burner Exposition to Be in Philadelphia

For the first time the Air Conditioning Manufacturers Association is officially participating with the Oil Burner Institute in the National Oil Burning and Air Conditioning Exposition to be held in Philadelphia, March 15-19. Displays will feature the newest oil burners, distillates and air conditioning equipment produced by leading manufacturers.

Electrical Goods Output Was Increased in 1936

Value of electrical products manufactured in 1936 will run close to $1,200,000,000, based on reports to *Electrical World* by a representative group of manufacturers. This compares with $912,000,000 in 1935, $742,000,000 in 1934, and $550,000,000 in 1933.

Trade Promotion Agencies Abroad Are Listed

A 12-page booklet entitled "United States Trade Promotion Agencies Abroad" has been issued by the Foreign Commerce Department of the Chamber of Commerce of the United States of America, Washington, D. C. This booklet, revised to November, 1936, gives street and cable addresses of American Chambers of Commerce abroad and of foreign offices of the U. S. Department of Commerce. It also lists all cities in which there are American consulates.

PERSONALS

HOWARD E. BLOOD, vice-president of the Borg-Warner Corp., for several years, has been made executive vice-president in charge of the various divisions. He is also president of the Norge, Detroit Gear & Machine, and Detroit Vapor Stove Divisions of the corporation.

JOHN B. HALLIDAY, shop superintendent of the Pere Marquette, at Wyoming, Mich., goes to the Canadian division as master mechanic at St. Thomas, Ont.

F. J. VEA has been made manager of the Trailer Co. of America, of Cincinnati. He was formerly manager of the New Stoughton Co., Stoughton, Wis., manufacturer of motor truck bodies, trailers and similar products.

Plymouth Master Mechanic

O. W. FRANKE

O. W. FRANKE has been appointed master mechanic of the Plymouth Motor Corp., according to an announcement by P. C. SAUERBREY, vice-president of production. Mr. Franke succeeds E. J. HUNT who has been advanced to the staff of C. E. BLEICHER, staff engineer under K. T. KELLER, president of the Chrysler Corp. For the past five years Mr. Franke has been with the Plymouth Motor Corporation in the tool division, and was Mr. Hunt's assistant. Before that he was with the Chrysler Motor Corporation from 1924 to 1928 as a designer and tool engineer.

RUSSELL T. KERNOLL has been appointed chief engineer of welded fabrication, Edge Moor Iron Works, Edge Moor, Delaware, according to an announcement by THOMAS J. DILLON, president. Mr. Kernoll has had many years experience in pressure-vessel and welded-equipment fabrication. He comes to Edge Moor Iron Works from the engineering department of M. W. Kellogg Company, Jersey City, N. J., and prior to that connection was associated for many years with the Struthers-Wells Company, Warren, Pa.

FORREST L. JOHNSON, for the past three years a tool engineer for the De Vilbiss Co., Toledo, has gone to the Alexander Milburn Co., Baltimore, Md., as superintendent. He has also been affiliated with the National Cash Register Co.

WILLIAM F. BARGE is now a tool engineer with the Wright Aeronautical Corp., Paterson, N. J. Mr. Barge was formerly chief tool engineer of the Lycoming Manufacturing Co., Williamsport, Pa.

Leaves Farrel-Birmingham

FRANKLIN R. HOADLEY

FRANKLIN R. HOADLEY, vice-president of the Farrel-Birmingham Co., Inc., Ansonia, Conn., was presented with a silver plaque by the employees of the foundry and pattern departments as a testimonial of respect, and the next day he was honored at a testimonial dinner by the executives and office force of the company. These marks of respect were paid upon Mr. Hoadley's resignation as vice-president, to become the president of the Atwood Machine Co., Stonington, Conn. He had been connected with the Farrel-Birmingham Company and its predecessor, the Farrel Foundry & Machine Company ever since graduation from Yale University in 1914.

Mr. Hoadley has been active in trade association work and continues his interest in that field. He was recently elected president of the National Founders Association and he is a member of the American Foundrymen's Association. He is a past president of the Gray Iron Founders' Society and was chairman of the Code Authority of the gray iron foundry industry when NRA was in force.

ARTHUR R. FORS has been made works manager of Airtemp, Inc., a subsidiary of the Chrysler Corp. Mr. Fors has been with Chrysler for several years in connection with plant supervision, and supervision of production and manufacturing. Before that he was general works manager of the Continental Motors Corp.

F. E. MOSKOVICS, has been made chairman of the executive committee of the Dictograph Products Co. He is also a member of the board of directors of the American Standards Association.

Heads Bullard Division

THOMAS H. WILBER

THOMAS H. WILBER has been appointed general manager of the Bullard-Dunn Process Division of The Bullard Co., Bridgeport, Conn. This division engineers and licenses the use of the Bullard-Dunn Electro-Chemical Process for the descaling of metals.

W. L. MARTWICK has been made general sales manager of the Foster Wheeler Corp. with headquarters at the New York office. Mr. Martwick has been with the company since 1926, when it acquired the Aero Pulverizer Co., of which he was president. He has had wide experience in engineering and sales work in connection with steam power plants and oil refineries.

J. I. ROBINSON assumed the office of vice-president of Crane Limited, Canada, on January 1. He succeeded J. AUSTIN MURPHY who has retired from active service after 51 years with the company. Mr. Robinson has complete supervision over Crane Limited and its subsidiaries.

HARRY C. CLOW has been elected secretary of the Eagle Lock Co., Terryville, Conn., to succeed the late CHARLES W. PLUMB. Mr. Clow has been with the company for a number of years as production manager and employment manager. In September, 1936 he was appointed assistant secretary.

ROBERT G. GUTHRIE, past-president of the American Society for Metals and consulting metallurgist for The Peoples Gas Light & Coke Co., Chicago, has been appointed chairman of the Ferrous Metals Committee of the Industrial Gas Section, American Gas Association.

At Bullard Detroit Office

THOMAS E. DUNN, JR.

THOMAS E. DUNN, JR., has been appointed to the sales department of the Bullard-Dunn Process Division, and will have his offices at 309 Miller-Storm Building, 12015 Linwood Ave., Detroit.

TOM BROWN has been promoted to vice-president and general manager of the Autovent Fan & Blower Co., Chicago, Illinois.

OBITUARIES

HENRY VOGT, 80, president and founder of the Henry Vogt Machine Co., Louisville, Ky., died December 27. He served as a machinist's apprentice and in 1880 opened a small shop for general machine repair work and the manufacture of elevators. Five years later the firm added a foundry and boiler shop, and in the same year the Vogt refrigerating machine was developed. With the introduction of ice machinery in oil refinery work, the Vogt firm began the manufacture of a general line of refinery equipment. In order to concentrate on machinery, the firm sold its elevator business to the Otis Elevator Company and in 1911 began turning out drop-forge valves.

BENJAMIN L. HIRSHFIELD, a director of the Blaw-Knox Co., Pittsburgh, died Jan. 2 from a heart attack. He was one of the original directors of the company when it was formed in 1906.

C. ELMER SMITH, president of S. Morgan Smith Company, York, Pa., manufacturers of hydraulic turbines, died Dec. 20 at the age of 73. He had been president of the company since the death of his father, S. MORGAN SMITH, the founder of the company, in 1904. Mr. Smith was also identified with the construction of hydro-electric plants and served as director of southern power companies.

EDWARD M. BENFORD, president of the former Benford Manufacturing Company of Mount Vernon, N. Y., at one time a large producer of spark plugs, died Jan. 5 at the age of 55.

J. F. MCCORMICK, former vice-president of the American Brake Shoe & Foundry Co., died Jan. 5 at the age of 64. He served as production manager with several large manufacturing concerns.

S. ARCH REPLOGLE, 64, secretary-treasurer of the Flood City Brass & Electric Co., manufacturer of mine supplies and equipment, Johnstown, Pa., died Jan. 3.

MEETINGS

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Winter convention. Engineering Societies Building, New York. Jan. 25–29. H. H. HENLINE, national secretary, 29 West 39th St., New York.

AMERICAN MANAGEMENT ASSOCIATION. Fifteenth annual personnel conference on industrial relations. Benjamin Franklin Hotel, Philadelphia, Pa., February 9–11. ALVIN E. DODD, president, 330 West 42nd St., New York, N. Y.

CANNING MACHINERY & SUPPLIES ASSOC. Chicago, Ill. Jan. 25-29. F. E. GORRELL, 1739 H St., N. W., Washington, D. C.

FIRST NATIONAL AVIATION SHOW. Grand Central Palace, N. Y., Jan. 28-Feb. 6.

NATIONAL COACH TRAILERS MFGRS. ASSOC. Clearwater, Fla. Jan. 29-Feb. 8. E. H. JUNGCLAS, secretary, 1718 Brockman Ave., Cincinnati.

NATIONAL OIL BURNER & AIR CONDITIONING EXPOSITION. Philadelphia, Pa., March 15-19. C. F. CURTIS, secretary, 30 Rockefeller Plaza, New York.

NATIONAL RAILWAY APPLIANCE EXHIBITION. Chicago, Ill. March 15-18. C. W. KELLY, 910 S. Michigan Ave., Chicago.

PACKAGING EXPOSITION. Hotel Penn, New York. March 23-26. Show managers — Roberts Everett Associates, 232 Madison Ave., New York.

BUSINESS ITEMS

Election of a new board of directors and managerial executives of The Whitney Chain & Mfg. Co., has been announced by CHARLES E. WERTMAN, president. One new addition to an executive position with the concern was announced. CARL A. GRAY, joins the company as vice-president and director. He was formerly connected with the Capewell Manufacturing Company as vice-president, and will have charge of production and engineering.

Officers of the company are as follows: CHARLES E. WERTMAN, president; WINTHROP H. WHITNEY, vice-president and treasurer; A. S. BASTEN and Mr. Gray, vice-presidents, and PARK C. BOYD, secretary and assistant treasurer. The new board of directors consists of ROBERT E. STEVENS, president of J. P. Stevens Company, New York, and Messrs. Wertman, Whitney, Gray and Basten.

The Foote Bros. Gear & Machine Corp., Chicago, has just completed an addition to the plant, giving more space for assembling and testing departments.

The Worthington Pump & Machinery Corp., Harrison, N. J., absorbed the Worthington Co., Inc., with offices in Seattle, San Francisco, Los Angeles and El Paso, effective January 1. Worthington Pump previously absorbed the Carbondale Machine Corporation on December 28.

The McQuary-Norris Manufacturing Co. of Indiana, which has been a wholly owned subsidiary of the McQuary-Norris Manufacturing Company, was dissolved on December 31, and since January 1 has operated as a division of the parent company. It will be known as the McQuary-Norris Manufacturing Co., Connersville Division, Connersville, Indiana. There will be no changes in operations or personnel.

The Highwall General Works has opened a new establishment under the name of the Highwall Metal Spinning & Stamping Co., Inc., at 97 East Houston St., New York, N. Y.

The Timken Roller Bearing Company, Canton, Ohio, has placed orders totaling $300,000 with various machine tool builders for new machinery and tools to increase capacity to produce bearings for locomotives and rolling stock.

The Camden Wire Co., Inc., Camden, N. Y., will move its automotive department from Reading, Pa. to Camden the early part of 1937, it has been announced by CHARLES HARDEN, president of the company. For some time the plant at Camden has been operating on a basis of 24 hours per day to keep up with demand.

Dano Mfg. Co., Winsted, Conn., incorporated in January, 1936 to manufacture electric coils, has leased a part of the Strong Mfg. Company's plant. The company has been conducting business in the Empire Knife Co. building on a small scale and now requires space for expansion. WALTER V. DAVEY is president and ROBERT L. NOBLE, vice-president.

New Haven (Conn.) Clock Co. has acquired a local factory at Guilford and steps will be taken at once to make it ready for occupancy. RICHARD H. WHITEHEAD, president of the company, has made no other specific announcement.

The Lincoln Electric Co., Cleveland, Ohio, has placed ROBERT DANIELS in charge of the Chattanooga, Tennessee office located at 1015 Hanover Street.

EXPORT OPPORTUNITIES

* Interested American firms and Individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office. Please refer to key number.

Joints and flexible connections universal. (Purchase.) Rueil-Malmaison, France. *2225.

Laundry machinery, especially a steam ironer, 4-roller. (Purchase.) Santiago, Chile. *2237.

Printing machine and type for printing gummed tape, electric motor or hand - propelled. (Purchase.) Caracas, Venezuela. *2239.

Mining machinery. (Agency.) Johannesburg, South Africa. *2224.

Slaughterhouse machines and equipment. (Agency.) Rio de Janeiro, Brazil. *2221.

Wheelbarrow, metal, manufacturing machinery. (Purchase.) Rio de Janeiro, Brazil. *2238.

Feather-cleaning machinery. (Purchase.) Cairo, Egypt. *2265.

Insulating machinery for electric wire, and for plating copper wire. (Purchase.) Poissy, France. *2280.

Ribbon-spooling machines. (Purchase.) London, England. *2258.

Slaughter house equipment and refrigerating machinery. (Purchase.) Rio de Janeiro, Brazil. *2256.

Steam boilers and distillery equipment. (Purchase.) Neiva, Colombia. *2259.

References concerning the following commission agents and importers can be obtained from the Business Publishers International Corporation, 330 West 42nd St., New York, N. Y.

Flint Hermanos, commission agent, Alsina No. 971, Buenos Aires, Argentina, is interested in industrial machinery, mining, oil and maintenance equipment.

C. Eckhardt Pastor, commission agent, Peru No. 84, Buenos Aires, Argentina, is interested in air conditioning, heating and ventilating equipment.

Jose de Avellar, commission agent, Rua Mayrink Veiga, No. 28, Rio de Janeiro, Brazil, interested in industrial machinery, railroad and public works construction equipment.

Ferreteria Central, Rodolfo de Roux, Apartado No. 34, Cali, Colombia. Importer. Information desired on industrial machinery tools and maintenance equipment.

Eliseo Osorio G, Apartado de Correos No. 247, Cali, Colombia. Commission Agent. Interested in all classes of industrial machinery and construction equipment.

Carlos Schmedling, Apartado No. 562, Bogota, Colombia. Commission agent. Interested in industrial machinery, power, electrical and maintenance equipment.

Alfonso Vasquez, Calle 52-49-109, Medellin, Colombia. Commission agent. Interested in industrial machinery and electric power equipment.

Varon y Quintero, Apartado No. 1528, Bogota, Colombia. Commission agent. Seeks additional lines and quotations on machine tools and general industrial machinery.

L. Vazquez Greiff, Apartado No. 801, Bogota, Colombia. Commission agent. Interested in industrial machinery, railroad and public works construction equipment.

Fermin Rodriguez, Compostela No. 171, Esq. a Conde, Habana, Cuba. Commission Agent. Interested in industrial machinery and electric power equipment.

George R. Hackley, 16 de Septiembre No. 52, Mexico, D. F., Mexico. Commission agent. Interested in industrial machinery, railroad, mining and public works construction equipment.

NEW BOOKS

ARC WELDING MANUAL. *Second Edition.—By W. J. Chafee. 94 pages. 5½x8 in., printed in two colors, fully illustrated, Fabricoid binding. Published by The Hobart Brothers Co., Box FW-116, Troy, Ohio. Price $1.00; will be mailed to readers of American Machinist for 75c. in stamps.*

New developments in arc-welding methods and applications, as well as in arc-welding equipment, have made it expedient to publish this completely revised second edition. Material is presented in a non-technical manner so that it will be useful to the beginner as well as to the experienced operator or technician.

Of the nine chapters, the first six are given over to a discussion of the welding arc, welding equipment, weldability of metals, types of joints and welds, strength of welds, and speed and cost of welding. The final three chapters cover instructions on the use of the metallic arc, welding with bare electrodes and welding with coated electrodes. Twenty-three practical exercises are included in these chapters to assist in training operators in proper methods.

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PROCEDURE HANDBOOK OF ARC WELDING, DESIGN AND PRACTICE. *Fourth Edition, 819 6x9 in. pages. Semi-flexible simulated leather binding. 990 illustrations. Published by the Lincoln Electric Co., Cleveland, Ohio. Price prepaid: $1.50 in the United States; $2.00 elsewhere.*

So fast does arc-welding technique advance that the Lincoln Electric Company is forced each year to make a considerable increase in the size of this well-recognized handbook. The fourth edition has been increased 32 per cent in number of pages, and 289 illustrations have been added, as compared with the third edition.

New information is included on such subjects as the welding generator, selection of the type of joint, welding codes, horizontal welds, sheet-metal welding, effect of electrode size on cost, methods of testing weld metals, the 4-6 per cent chrome steels, monel metal, and principles of surfacing by welding.

New applications of arc welding are discussed in connection with manufacture of automotive parts, cranes, earth-moving equipment, furnaces and heating boilers, furniture, special tools, jigs and fixtures, cutting tools and dies, machinery and machine parts, general maintenance and repairs, sheet-metal work, ships, barges and small craft, steel mill equipment, tanks, trucks and trailers.

There are eight sections in this encyclopedic work: Welding Methods and Equipment; Technique of Welding; Procedure, Speeds and Costs for Welding Mild Steel; Structure and Properties of Weld Metal; Weldability of Metals; Designing for Arc Welded Steel Construction of Machinery; Designing for Arc Welded Structures; and Typical Applications of Arc Welding in Manufacturing, Construction and Maintenance.

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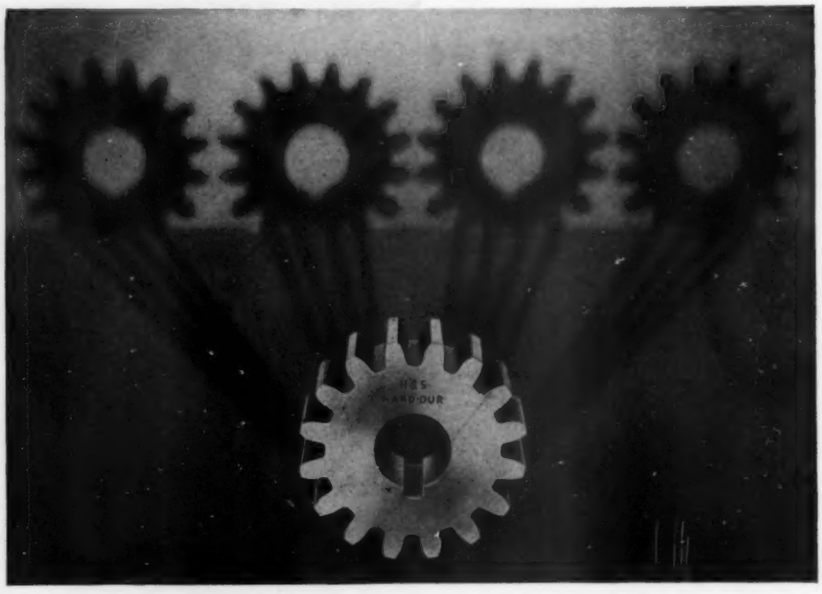
BOOK OF A.S.T.M. STANDARDS, PART I—METALS—*898 pages, 6x9 in. Indexed and illustrated. Cloth-bound or half leather binding. Published by the American*



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at only 50 per cent extra . . .

"HARD-DUR" Gears preserve the tooth form. They are made only of the finest gear steels and are scientifically heat treated to obtain the maximum physical properties. They are so much stronger, harder and more wear-resistant than similar untreated gears that they are guaranteed to have four to five times the life at only 50 per cent extra in cost. "HARD-DUR" Gears handle the tough jobs on which ordinary gears fail and when used on the average job they last almost indefinitely. A trial will prove their superiority and economy.

A valuable 448 page Gear book will be sent on request.

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GEARS AND SPEED REDUCERS

HAMILTON AVENUE, CLEVELAND, OHIO, U. S. A.

Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price, cloth, $7.50; half leather, $8.50. A.S.T.M. members may deduct $2.50 from these prices.

Published triennially, this reference work forms the official record of A.S.T.M. standardization. Part I, under review here, covers metals; Part II, non-metals.

Of the 181 standards contained in Part I, 109 relate specifically to ferrous metals, 60 to non-ferrous metals and 12 to metallic materials in general. Standards adopted by the Society in 1937 and 1938 will be covered by supplementary pamphlets; the next edition of the Book of Standards will be published in 1939.

For convenience of the reader two tables of contents are supplied. One of these lists the standards in the order in which they appear in the volume, grouped according to the subjects to which they relate. The other lists standards in numerical sequence of their serial designations. A complete subject index, covering those standards appearing in this volume, appears in the back of the book.

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FACTORY EQUIPMENT—*By J. W. Roe, professor, and C. W. Lytle, assistant professor of industrial engineering, New York University. 500 5¼x8¼ pages. Flexible binding. Published by the International Textbook Co., Scranton, Pa. Price $3.50.*

In teaching shop equipment and methods to engineering students, the authors have found it necessary constantly to supplement the material found in Professor Roe's book, "The Mechanical Equipment." That work is now out of print, but its discussion of essential principles is carried over into the new volume. Of course, the equipment described is of modern design, and much additional material has been added on new processes and materials to change the scope of the book entirely.

Each of the 25 chapters and the five appendixes is short for the reason that basic principles are being taught, not detail operation or application. The bulk of the volume is concerned with machine tools, but there are chapters on buildings, drafting room, pattern making, foundry work, forging, press work, welding, heat-treating, jigs and fixtures, inspection, and materials handling. Coming after the chapters on equipment, there is one on selection of equipment that summarizes and compares the fields for machine tools, goes into the economics, and includes charts on initial and operating costs. Effects of alloys on steel, a classification of stainless steels, and a designation of steel and aluminum alloys are subjects found in the appendixes.

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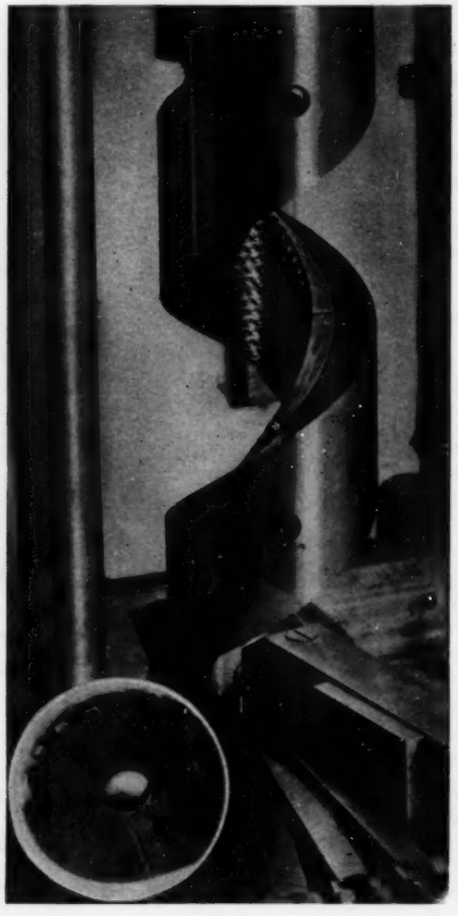
FLOW METER ENGINEERING HANDBOOK. *1936 Edition. Compiled and edited by Louis Gess and J. O. Feldmark, Flow Meter Engineering Dept., The Brown Instrument Co. 162 pages, 7½x10¼ in. Published by The Brown Instrument Co., division of Minneapolis - Honeywell Regulator Co., Wayne and Roberts Ave., Philadelphia, Pa. Price $2.00.*

The object of this handbook is to familiarize the reader with the correct design, installation and operation of flow meters. A complete outline is given of the essential features common to all types of flow meters.



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While making window regulators probably is not one of your problems, it is just another reminder that if a part should be broached—it's 9 chances in 10 Colonial broaches are doing it somewhere—better, cheaper and faster.

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Particular attention is paid to a detailed description of methods used in the correct design of the differential pressure producing element, known as the thin-plate orifice. Data tables and examples are given for steam, water, liquid, air and gas flow measurement. All theory is illustrated with charts, photographs and sample problems.

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WROUGHT IRON—*First Edition, By James Aston, consulting metallurgist, and Edward B. Story, chief metallurgist, both of A. M. Byers Co. 59 pages, 6x9 in. Illustrated; does not contain advertising. Published by A. M. Byers Co., Pittsburgh, Pa. Price $1.00, free to executives inquiring on company letterhead.*

The manufacture of wrought iron is the oldest branch of the ferrous-metal industry, but details of the methods employed have not been generally known until recent years. Rapidly growing demand for this metal in many different products has been accompanied by a need for data on qualities and application. This book is published to meet that need.

It is designed to serve as a source of up-to-date information on wrought iron for architects, engineers and others who have occasion to specify or use the material. The first two chapters deal with early production methods and preliminary research work that now forms the basis for modern production methods. Present day production practice is discussed in the third chapter. Other ductile ferrous metals, quality standards and characteristics of wrought iron and its principal applications are treated in the succeeding four chapters. The last chapter discusses factors that must be taken into account in proper material selection.

TRADE PUBLICATIONS

ABRASIVE PAPER AND CLOTH. "Coated by Artificial Lightning" is the title of an 8-page booklet published by the Behr-Manning Division of Norton Co., Troy, N. Y. This booklet describes briefly the electrostatic method by which abrasive grains are arranged on the "Lightning" abrasive sheets.

ARC WELDER. A 4-p. bulletin recently offered by the Lincoln Electric Co., Cleveland, Ohio, describes the characteristics and advantages and lists the specifications of the dual control "Shield-Arc SAE" welder. The a.c. motor-driven models are available in 200, 300, 400 and 600 amp. capacities.

AUTOMATIC ELECTROMIL. The automatic No. 2 Electromil is described in a 12-p. circular published by the Sundstrand Machine Tool Co., Rockford, Ill. This machine is an electrically controlled rigidmil for high-speed operation on small workpieces.

BASIC INDUSTRIAL MARKETS. The Marketing Research Div., Department of Commerce, Washington, D.C., announces publication of a basic industrial study of the iron and steel industry of the United States. It is the second of the series covering basic industrial markets of the United States and has been prepared to lo-

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cate and measure this large market for manufacturers who sell to the iron and steel industry. This is Market Research Series No. 14.2 and may be purchased from The Bureau of Foreign and Domestic Commerce, Washington, D. C., at 10 cents each.

BELT LACING. Bulletin No. 725 offered by the Bristol Co., Mill Supply Division, Waterbury, Conn., describes the Brisol steel belt lacing. Prices, sizes, and other data are included for various types of lacing.

BROACHING MACHINES. Bulletins describing the "Utility" and the heavy duty "Pull-up" lines of broaching machines are offered by the Colonial Broach Co., Detroit, Mich. Specifications are listed for the various models.

CHAIN DRIVE DATA. The Link-Belt Co., 519 N. Holmes Ave., Indianapolis, Ind., has published a 96-page, 1936 edition of Data Book No. 125 on Silverstreak Silent Chain Drives of fractional to 2,000 hp. The contents include installation pictures, engineering data, recommended drive selection, price list, and tables of dimensions of various parts.

COLLECTIVE BARGAINING. "The Performance of Unionism in Heavy Industry" is the title of the 20-page booklet No. 19 offered by Farrel-Birmingham Company, Inc., Ansonia, Conn. This booklet embodies the results of the latest study by Rucker and Pickering.

COMBUSTION TUBE FURNACES. Bulletin HD-1236 offered by Hevi-Duty Electric Co., Milwaukee, Wis., describes the line of combustion tube furnaces of both the hinged and solid types. These furnaces can be operated on either 115 or 230 volts and are particularly adaptable for laboratory purposes.

CRANK PIN GRINDERS. The Landis Tool Co., Waynesboro, Pa., has issued Catalog No. N-36 describing the Landis 16 in. Type D hydraulic crank pin grinders. The catalog is well illustrated and lists specifications for the standard 16 in. machines.

CUTTING OILS. The Swan-Finch Oil Corp., 205 East 42nd St., New York, N. Y., has published a 4-page bulletin describing the advantages of "Safco" cutting oils for milling, turning, gear cutting, drilling, broaching and other machining operations.

ENGINE LATHES. The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, is mailing a folder, publication No. 462-H-1036, describing and listing specifications for the 36- and 42-in. triple-geared selective-head lathes. These lathes are designed for heavy-duty service.

FINANCIAL COUNSEL. The Industrial Corp., Lexington Bldg., Baltimore, Md., offers a booklet on "Financial Counsel" in which is discussed a few of the problems now being faced by management. Supplementing this booklet, a comprehensive portfolio "The Industrial Study —Facts and Decisions" which presents graphically certain important findings affecting the profitable operation of an enterprise is available.

FORGINGS. The Champion Machine & Forging Co., 3695 E. 78th St., Cleveland, Ohio, is offering a folder to describe their facilities for producing forgings of all types, ranging in size up to 600 lb. each.

FURNACES. Bulletin No. 10 offered by Ajax Electrothermic Corporation, Ajax Park, Trenton, N. J., describes the 35 kva. converters and furnaces

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for melting alloys, surface hardening and other purposes. A new hydrogen governor that saves both gas and operator's time, and an improved 60 lb. furnace for non-ferrous melting are described.

GALVANIZED SHEETS. A folder, P. O. 73, describing the advantages of Armco galvanized Paintgrip Sheets has been issued by The American Rolling Mill Company, Middletown, Ohio. Paintgrip is the new Armco galvanized sheet metal that is readily paintable without special treatment.

HACKSAW BLADES. Simplified Practice Recommendation R90-36 for hacksaw blades, superseding recommendation R90-29, has recently been published by the National Bureau of Standards, United States Department of Commerce. Copies are available from the Superintendent of Documents, Washington, D. C., at a price of 5 cents each.

INCLINABLE PRESSES. A sectional catalog devoted to Bliss inclinable open back presses is announced by the E. W. Bliss Company, 1420 Hastings St., Toledo, Ohio.

KNIFE GRINDERS. Bulletins, recently published by Samuel C. Rogers & Company, 191 Dutton Ave., Buffalo, N. Y., describe the Type CC circular knife grinder and the improved Types F and W straight knife grinders. Each bulletin describes the features of the machine and lists specifications.

MANGANESE STEEL. Applications and characterictics of "Rol-man true manganese steel" are listed in a 48-page booklet offered by the Manganese Steel Forge Co., Richmond St. and Castor Ave., Philadelphia Pa. The composition of "Rol-man" rolled manganese steel precisely follows the accepted "Hadfield Formula."

METAL COATING. File Folder No. 1206 offered by the Metals Coating Company of America, 495 N. Third St., Philadelphia, Pa., describes the "Metalayer" sprayed molten metal coating (Schoop) process. A complete description of the process and equipment are given and interesting photographs are shown of typical coatings.

OXYGEN LANCE. An 8-page booklet, illustrated with diagrams and pictures, on the oxygen lance is available on request through the Linde Air Products Co., 30 East 42nd Street, New York, N. Y. Much information on the oxygen lance is given in convenient form.

PERFORATED SHEETS. Three bulletins, offered by the Erdle Perforating Co., 165 York St., Rochester, N. Y., describe the "Epco" perforated sheets for machinery guards and ornamental purposes.

PLASTIC MATERIAL. The Plastics Department, E. I. duPont de Nemours & Co., Inc., 350 Fifth Ave., New York, N. Y., has issued a 16-page bulletin describing the properties of a new organic plastic which will be marketed under the trade name of "Pontalite". This material will be sold as a cast resin in the form of sheets, rods and tubes and as a thermo-plastic molding powder. In both forms it will be available as a crystal clear product in a wide variety of colors.

SOCKET HEAD SCREWS. A data sheet giving complete information on socket head cap screws, stripper bolts and pipe plugs as approved by A.S.A., February, 1936, has been published by The Bristol Co., Waterbury, Conn. Data are also included on the Bristo socket set.

Example No. 1428 — Automobile piston core box just as it came from the Duplicator. Reproduced from polished cast iron model in 2½ hours within limits of .001" for all dimensions. Flat faces and circular inside portions were finished before duplicating. Two cuts, roughing with a single flute Gorton cutter and finishing with a special 16 flute ball nose cutter ¼" diam., removed approximately 3/32 of stock. 480 of these core box halves were reproduced from chilled cast iron in this way.

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Any reasonably good mechanic can learn in a day or less to duplicate dies within tolerances of .001 in. on a Gorton Duplicator. The operator works directly from the original die or a built-up master. This method saves time and errors compared with laying out work from complicated drawings.

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1103 13TH ST., RACINE, WIS.

Dies Depend on Dowels

H. R. HAGEMAN

IN AN article under the above title (*AM*—Vol. 80, page 652), Charles Weslow shows a knowledge of some of the major difficulties encountered in die making, but many diemakers will object to his methods of coping with them.

I have observed the work of numerous diemakers: good, poor and indifferent, but only the poorest would think of fitting dowels to distorted or untrued holes, preferring always to lap the holes to fit standard dowels. On rough work or on a job that is in a great rush, the holes might be lapped with a polishing rod made by wrapping a strip of abrasive cloth around a rod having a slot for holding one end of the strip. If care is exercised, that method will quickly produce a fairly accurate job—much better than unlapped holes—especially if they are in carbon steel, as the holes in such cases are invariably tight in the center.

The reamer problem is a live one. It is my practice to keep a set of the well-known gun reamers 0.0015 in. under size for finishing the holes. When suitable drills are not available, I make other gun reamers that leave not more than 0.010 in. for the finishing reamer. Such reamers may be run through holes in hardened steel with impunity.

As for commercial dowels, if Mr. Weslow is having trouble with the ones he uses, I would suggest that he try the product of another manufacturer—not all dowels are made as he describes.

I think that Mr. Weslow's idea of special die screws is ill advised, in as much as such screws would call for special counterbores. Besides it upsets the findings of A.S.M.E. and the Bureau of Standards without accomplishing anything of value. The heads of standard fillister-head capscrews are large enough in diameter for all practical purposes and most modern die shops use socket-head screws. If straight-sided screwdrivers are used, garage methods will not be necessary to tighten screws. Standard-head capscrews can be held in spring collets for facing off the heads for stripper screws.

The idea of having screw heads filed flush with the tops of punch-holders may sound clever, but long experience has shown that it is not of sufficiently practical value to compensate for the extra work, which includes marking the heads so they may be replaced in their proper places when it has been necessary to remove the pads. Besides, the screws salvaged from what Mr. Weslow terms a "sloppy job" are more suitable for re-use.

Driving power of a chuck? Yes—motors, transmissions, bearings—all the things that mean power to a drilling machine, a lathe, a portable drill are useless, might just as well be non-existent, without the chuck to take all that power, connect it to a tool and drive it into the work.

There are two main reasons why Jacobs Chucks are the standard of all comparison—absolute reliability of quality and workmanship — long wearing grip. Illustrated is the Jacobs Ball Bearing Super Chuck—the last word in modern chuck construction.

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Sinking-In vs. Dowels

E. G. MARSHALL
Master Mechanic, Charleston Works
The American Fork & Hoe Company

I DO not believe that a die can be made according to the method advanced by Joseph A. Falk (*AM*—Vol. 80, page 885) and be held to close tolerances for a large number of parts. It is true that socket-head screws can be tightened more than standard fillister-head screws, but screws of any type cannot be relied upon to hold sections of the die in

place. Dowels of any type are not dependable beyond a certain point.

Dies that are made to close tolerances, where the punch is fitted close to the die to give little or no break in the part, exert a tremendous spreading force on a sectional die block. This is especially true when the blanking tonnage runs about 50 tons. When the spreading force is greater than the resistance of the die shoe to crushing ahead of the dowels, the sections will move. To maintain the accuracy over 500,000 blanks, it is best to back up the die sections by sinking them in the shoe.

Relative to Mr. Falk's suggestion on using drill rods for dowels, I will say that a ground dowel contacts all along the hole, whereas others may not. Commercial drill rod is not very accurate in diameter, or perfectly round, and the finish is not as smooth as secured by grinding. Moreover, in filing a cylindrical piece in the lathe it is the tendency to get flat spots. Then, high carbon tool steel when hardened in water, will bend more or less. Unless the dowel is ground after hardening, the effect will be of driving a bent dowel in two straight cylindrical holes and to move the pieces out of line.

May I also point out that a reamer made of drill rod as suggested by Mr. Falk is, after all, composed of high-carbon tool steel, which in some cases is not as good as the steel the die is made of. While the home-made reamer might be hardened, it would not last as long as if made of high-speed steel. Properly ground and stoned, a high-speed steel reamer will wear longer and cut smoother and more nearly to size, than a home-made reamer. Also, I believe it will be cheaper for the company in the end.

Dowel-pin holes should be lapped because steel distorts in hardening, particularly the water-hardening variety. The tendency for the hole is to go bell-mouthed. A dowel that would be a tight fit in the center would have several thousandths play at the outside edges of the hole. This play would allow the die sections to move when a spreading force was exerted. Very careful lapping or grinding will give a straight round hole. In conclusion, I must say that to produce accurate stampings a true cylindrical dowel must be used in a true cylindrical hole, and it must be, furthermore, a correct drive fit. When the forces tending to move the sections are great enough, a solid backing should be provided such as given by sinking in.

Sensible Safety Rules

SAFETY rules are not always made by men with a practical background. In such cases they are likely to be arbitrary. The following introduction to safety rules for machinery and its control, in U. S. Navy Yards and Naval Stations, are to be commended for their very evident common sense:

"The purpose of the rules is to provide reasonable safety for life, limb, and health for the men working in Navy Yards.

"They should be liberally construed and applied to secure these results; and, in case of practical difficulty or unnecessary hardship, exceptions from the literal requirements may be granted as long as equivalent protection is secured. Where specific devices or methods are mentioned, other devices or methods which will secure equally good results may be used."

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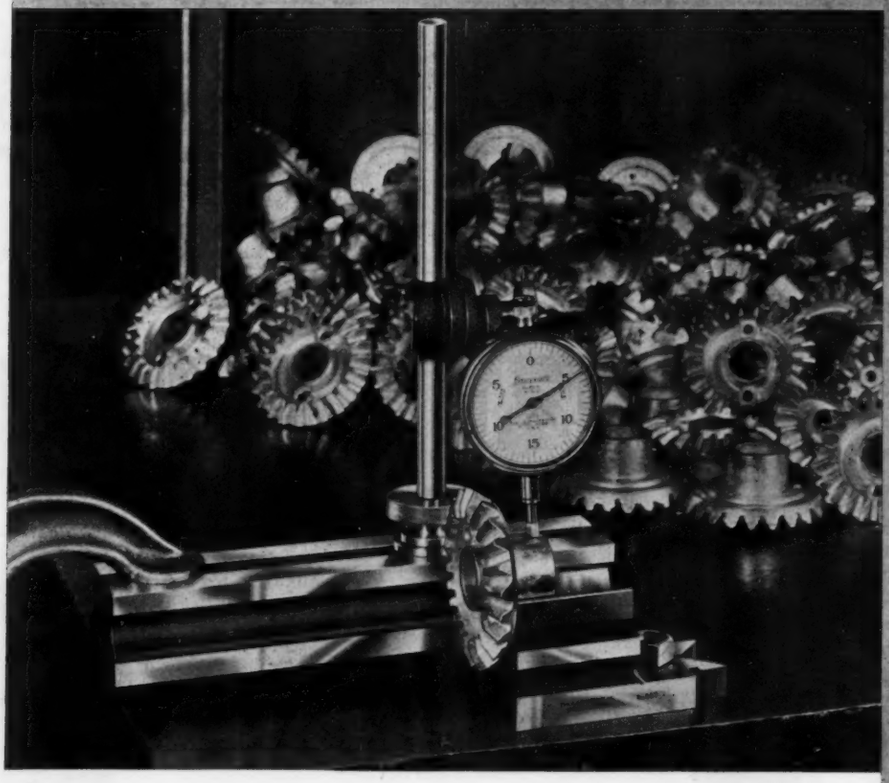

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